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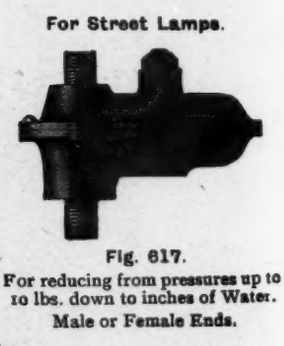

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EDITORIAL NOTES.

Gas Bill and Order Promotions.

RECORDS have been established during the war years in the number of promotions of Gas Bills and Provisional Orders; and each year appears to attempt to beat the record of the one preceding. These records are not in the direction that those concerned in the promotion of private measures in Parliament would prefer; being at the bottom end of the scale. This year sees the number of notices of gas promotions lower than that of last year—indeed, it is not far removed from vanishing point. For this condition of things, there are various reasons. In the first place, the Government does not want to be troubled during the war with more promotions than are absolutely necessary, and particularly promotions of a controversial nature, which would occupy valuable time in Committee proceedings. Other reasons are found in the Treasury restriction upon capital expenditure; and the incapacity, owing to munitions work, of most of the plant makers to promptly execute any considerable orders. And a still further reason is that, though for gas men work and business were never more time-absorbing than now, and there has been a large consumption of gas in many areas for purposes other than lighting, the curtailments of consumption for lighting, through the written edicts of authority and the unwritten ones of economy, have, in many instances, combined with the higher makes of gas per ton, provided a temporary surplus of producing plant which will stave-off extensions for at all events a time, or until circumstances are more propitious.

Nevertheless, in our opinion, it is not wise, if conditions presage an early need on the return of peace for additional works, to postpone the making of applications for the necessary powers either to Parliament or to the Board of Trade, as it will be better to be prepared to proceed with the work directly there is release from the capital-creating prohibition, and the opportunity for raising money is more favourable. It was not long since that the Board of Trade issued a notification that they would be prepared to consider applications for Provisional Orders which did not threaten to provoke serious opposition, and which did not contemplate capital expenditure this side the close of hostilities. But, judging from the "Gazette" notices of applications for Orders—we can only find two in the gas line—the administrators of gas undertakings at all events have not on this occasion responded to the invitation. The after-war efforts that are going to be made by this country in industrial output and trading at home and abroad to the disadvantage of our enemies should have a substantial effect on the demands made upon many gas undertakings; and it would be a pity if, as a result of this, undertakings then found themselves deficient of powers to meet the situation, and were tied up for a year or two from prosecuting the necessary work while application was being made for the requisite authorization to Parliament or one of the two Departments dealing with Provisional Orders.

However, that is now looking forward to the session succeeding the coming one, seeing that the preliminaries in regard to the publication of notices have been completed for the Gas Bills and Orders that will be seen at Westminster next session. They are few indeed—only eight Bills and two Orders; and they are not of a character that should claim much time in discussion. The Gas Light and Coke Company and the Sheffield Gas Company are the principal promoters; but, judging from the notice, the Bill of the former is purely of a domestic character. They want more ships, lighters, and other vessels, and financial powers in relation thereto. They are proposing annual meetings; and while they have already a Managing-Director in Mr. D. Milne Watson, they now want to be invested with certain authorization in connection with such appointments. The annual meeting is, as with the railway companies, getting quite a fashionable institution with gas companies; and meeting once a year seems sufficient, seeing that the separate half years have distinctions of their own in the matter of trading which do not afford the ground, the same as does a full year, for a comprehensive presentment of the position and condition of the concern. At the same time, there are certain habit-hardened shareholders who like to "meet" the Directors in the old way every six months—ostensibly to keep in close touch with just as much of the conditions affecting the Company's business as a judicious or injudicious Board choose to tell them. Thus there is always opposition to the elimination of one of the two meetings during the year; but Boards favouring annual meetings generally manage to get their own way in the matter.

The Sheffield Company are asking for capital powers (including conversion and consolidation) and works authorization, and other of the few promoting companies are doing the same. There is noticed an increased desire to possess powers to purchase coke-oven or other gas either partially purified or in a crude and unpurified state. The Sheffield, the Lea Bridge, and the Hemel Hempsted Companies will ask Parliament to confer power in this connection. Price conditions will be dealt with in one or two cases. The Lea Bridge Company desire to be authorized to charge according to the purpose for which gas is used, which is a power worth possessing in these competitive days. The South Staffordshire (Mond) Gas Company apparently find their statutory limitations in regard to price are not adequate to these times, and so are seeking revision. Being in Parliament, the Haslemere and District Gas Company will ask for a calorific power standard, and so will not apply to the Board of Trade under the new Act; and the Hemel Hempsted Company, seeking relief from the illuminating power test, will, we take it, wish for the calorific standard. Certain gas undertakings—including Blackpool—are desirous of extending their area. Residual products powers are to be sought by the Sheffield, Lea Bridge, and Hemel Hempsted Companies, the nature of which will only be disclosed when the Bills are before us. In some of the measures will be found provisions in which gas workers will be concerned—such as profit-sharing, pensions, transfer of stock powers, &c. But at the best, the measures are not likely to be productive of any large amount of interest, though the uncertainties of proceedings in Parliament forbid any positive declaration to that effect.

Benzol Extraction.

THE coke-oven industry has had a long experience in the oil-washing of gas for benzol recovery; and although gas engineers have been looking to the technical men of the kindred carbonizing industry for guidance in respect of the details of the working, it appears from the paper [*ante*, p. 447] read by Mr. J. A. Wilson before the Midland Section of the Coke-Oven Managers' Association, and the discussion thereon, that coke-oven managers themselves have not arrived at a solution of all the problems that occur in connection with benzol extraction, and which problems are intensified when one comes to deal with a gas which has to be distributed of a specified quality in respect of calorific value, and which shall occasion little or no trouble in the distribution system through the deposition of naphthalene. Practice in regard to working temperatures and much else is varied as between different extraction plants at the coke-ovens; and the managers are not backward in confessing their limitations in knowledge of various phases of working, as well as of the more extensive problems which assail the town-gas engineer. It is therefore not surprising to find one speaker advocating that, as benzol recovery is a matter of national importance, efforts should be made to obtain a grant from the Government for the purpose of carrying out research. However, existing experience (whatever be its

nature) is valuable; and therefore the technical men of the gas industry will be grateful to Mr. George Chrisp, the Chairman of the Midland Section of the Association, for his promise that the coke-oven men will be glad to give gas men any and every possible help.

There appears to be a new-born desire on the part of coke-oven managers to attain the best standards of efficiency set by the working results of some of their colleagues. That they have not done so before is due to what Professor W. A. Bone and others have pointed out on previous occasions—that so many of the coke-ovens plants and their accessories lack that chemical supervision which is so very essential to the highest working standards. Mr. Wilson in his paper recognizes and urges this. Temperatures of gas require careful watching, and so does the quality of the wash-oil. The area of the scrubber, too, in relation to the quantity of gas dealt with, and the question of time-contact between the gas and the oil, are matters for control. In fact, at every point in the washing and distillation system, there should be supervision. For example, in regard to the latter, there is the point as to the degree to which the still debenzolizes the oil. The best temperature at which to work the crude benzol still is also one that will repay investigation. And one of the surest means of keeping a firm control over the efficiency of the whole plant is to ascertain the amount of benzol in the gas before the stripping begins, and then the amount extracted from a given volume of gas. Attention to all these matters will give information of considerable value in the work of control. Even Mr. Wilson, however, insistent as he is upon this question of supervision, admits a disadvantageous condition in connection with the ammonia content of the water in his wash-oil. He says that it is as much as 5·5 per cent. This is a waste of ammonia; and there has been such large experience of its corrosive action in the oil-heating system that, for the sake of maintaining the integrity of the oil-heaters, efforts should be made to afford every possible protection against the ammonia by attempts to reduce it to the lowest possible amount. In an article in this issue by Mr. D. Bagley, is described a simple benzol plant; and incidentally he says that in it any steam-heating coil damaged by ammonia can be repaired and replaced without interfering in any way with the continuity of the process.

In the same article, Mr. Bagley deals with certain other matters that have of late been freely discussed in the gas industry in connection with the adoption of oil-washing. He refers, for example, to the importance of the thermal constancy of gas, in view of having to work to a calorific value standard. It is obvious that, if one could have the wash-oil always constant and the absorption constant—there would be, providing the composition of the unwashed gas was also constant, thermal constancy of the treated gas. But, as Mr. Bagley points out, such a constancy of conditions is not possible with the wash-oil, in view of the fact that it is ever, while in circulation, increasing its content of benzol and naphthalene. Consequently, the thermal value of the treated gas is, he suggests, continually rising through the reducing benzol absorption due to the decreasing avidity of the oil with growing saturation. But, at the same time, it is Mr. Bagley's view that it is possible to work within well-defined limits. We agree on the surest of all grounds—that found in the large accumulation of actual gas-works experience, which accumulation is daily broadening its bounds. The diffusion of gases in the holders eliminates any differences there may be in the calorific value of the gas at progressive points in the application of the washing oil. There is a good deal of give and take promoted by the process of gas diffusion in a gas-manufacturing system in which the retort charging is done intermittently, and the evolved gases are of totally different character in regard to quality at different periods of the carbonization of the same charges. But there is system even in the disorder; and, through intermixing and diffusion, there is, in the bulk and in the gas sent out into the distribution system, a uniformity of composition and of calorific power, and the calorific power is only reduced by the oil-washing, as practised on gas-works, by a percentage amount that is entirely negligible. Mr. Bagley suggests that a less valuable commodity than benzol might be employed for making up any deficiency in the calorific power; thus permitting of maximum extraction continuously. This is unnecessary. The gas industry does not want to complicate its system by again adding to it the process of gas enrichment. It has had enough gas enrichment to last it—well, for ever; and it can supply a good calorific value gas, and make a good contribution to benzol supplies, without having recourse to it again. Mr. Bagley talks hopefully on the subject of the naphthalene difficulty, and suggests the possibility of maintaining, in the working of the plant, such a balance of conditions in respect of the gas itself that there should be no trouble. As he does not speak of seeking aid from outside means, such as spraying or vaporizing oil into the gas to compensate for the loss of the naphthalene carriers, gas engineers would be very glad to be informed to a larger extent as to what is in Mr. Bagley's mind. If he can avoid naphthalene deposits without troubling to specially treat the gas with a view to their prevention, gas engineers will fervently bless his name.

Under Government Control.

Developments in one coal-field have often an important effect upon other fields; and, therefore, although the gas-undertakings that draw on the South Wales coal-field for supplies are, practically speaking, confined to the local ones, what has happened in connection with it may have an important bearing, for (let us hope) good, upon other coal-fields from which the larger supplies for gas-making purposes are drawn. The trouble in the South Wales coal-field arose out of the circumstances explained last week—chiefly the demand of the men for a 15 per cent. increase of wages, while the owners were suggesting a 10 per cent. reduction; the miners' claim being partially traceable to the permission of the Board of Trade to owners to increase the standard excess price chargeable for South Wales coal from 4s. to 6s. 6d. per ton. The suspicion that the concession was made without the whole of the facts being in the possession of the Board appears to be confirmed by the letter addressed by the Board to the Miners' Federation on Saturday, in which they speak of an independent audit being now undertaken "to ascertain the facts in regard to "the increase in the cost of production." Thus, it would seem, the "facts" had not previously been ascertained by the Board. However, as to the trouble, it was found as the result of negotiations conducted under the auspices of the Board that the difficulties between the parties were incapable of composure; and therefore the Government adopted the bold and vigorous course of taking-over as from Friday last the control of the mines—some 625 are involved—in this area of perpetual disaffection. The step has met with approbation nearly everywhere, excepting among those most closely concerned. But exactly what is going to happen as the result is veiled, as the decision of the Government came upon the parties in the nature of a surprise, albeit it was recognized as having some place among the possibilities. Although the owners do not express themselves openly on the subject, there are significant indications as to the feelings that exist among them regarding the Government action. The "Iron and Coal Trades Review," which shows a fidelity to the interests of the owners which should merit their highest regard, says that the action of the Government cannot be otherwise described than as a complete surrender to the men. It may also betoken want of confidence in the owners. But what does Government control mean from the owners' point of view? The main result must be fixed profits; and there was such quick perception of this that the market value of the colliery shares went tumbling-down with an alacrity which showed that at all events some of the proprietors had bought at high prices with a view of enjoying a continuation of rich war-made dividends, and that fixed profits were repugnant to their personal notions. The Government are not likely to suggest dividends on a scale that are in any way unfair—they have not done so in connection with any other establishments brought under their control; and, therefore, the slump in South Wales coal share prices tells its own tale.

On the part of the men, they are of opinion that the Government ought not to have taken over control of the mines without consulting them. But, the Government having done so, the miners adhere to their claim for a 15 per cent. increase in wages, and have already protested, through the Executive of their Federation, against State control being exercised over limited territory, instead of being upon a national basis, with profits going to the community instead of into private pockets. This is a socialistic order too tall by far for contemplation during the progress of a war. However, prospective limitation of profits notwithstanding, the men are, it is seen, not disposed to relinquish their claim to an increase of wages; but they were,

prior to this action of the Government, so insistent as to the maintenance of the principle of the relationship of wages to profits as the basis of settlement, that—being, as they do not deny, extremely well paid—they cannot, if the rate of fixed profits does not admit of it, contend with any degree of consistency for so large an increase as that proposed, in view of what they have already gained in pay since the war started. There is no telling what will occur where South Wales miners are concerned. Their minds have a curious bent and flexibility, and so has the morality of their actions. There is some question as to whether even now they will not, ignoring all questions of national interests and safety, do something rash if they cannot realize their aim; and it cannot be said that the South Wales men are much better disposed towards the Government than they are towards the coalowners. However, the question of a further advance is not now one of dispute between the masters and the men, but one for discussion between the latter and an Inter-Departmental Committee of the Board of Trade, the Home Office, and the Admiralty, to whom has been entrusted the work of devising a scheme of control, and to deal with outstanding questions. The Executive of the Miners' Federation are not by any means, at the outset, taking up an antagonistic attitude towards the Inter-Departmental Committee. They are feeling their way; and the hope of every disinterested one must be that the result will be one in which the interests of the nation will ride uppermost. Any way Government control definitely ends unlimited profits; and this, if there was any reality in the men's attitude, means the removal of the main cause of the renewed disruption, and should conduce to maintenance of peace. Meantime, no change is apparent at the collieries; the managements having received instructions to carry-on as usual, pending any fresh orders that may be issued by the Committee. [Since the foregoing was written, the Government have allowed the 15 per cent. increase, but subsequent adjustment is contingent upon the results of the audit now being instituted, taken in conjunction with relevant factors.]

From Coke-Oven and Pit-Head.

TIME was when we and many others used to smile at those who advocated that central stations should be established in the coal-fields for the carbonization of coal for the manufacture of gas and secondary products, with the distribution of the gas either through a high-pressure system, or its utilization for the generation of electricity. We were wont to call these people visionaries; we still think they are, considering from the economic side their proposals in all their fullness. At the same time, we are already beginning to regard them and their ideals with somewhat less disrespect than formerly; for it is quite possible that, within limits, these ideals may receive consummation—in fact, they are already doing so in a small degree. Let us see. Coke-ovens are usually located at collieries. The Middlesbrough Corporation are purchasing gas from an extensive coke-oven plant, and are distributing it in their area of gas supply with advantage to themselves and to the owners of the coke-ovens. On a smaller scale, the same thing is being done elsewhere in the country. It is being carried out on the large scale in America and on the Continent. Various municipal authorities in this country who own gas-works have also obtained statutory power to purchase gas from bulk producers—such as coke-oven plant owners. And now the Sheffield Gas Company are about to ask Parliament for authorization to purchase "coke-oven "gas and gas in a crude and unpurified form," as well as to make provision with reference to the conditions to be observed in connection with the supply of gas for power. Then there are on the North-East Coast certain electricity companies, in which Mr. C. H. Merz is concerned, taking "waste heat"—in other words gas from local coal-carbonizing and iron works, and either burning it under steam-boilers or utilizing it in gas-engines for the production of electricity. There are also the large territory-covering electric power companies affording example of what could be done. There is the Yorkshire Company, which has bargained for a gas supply (to be used for electricity generating purposes) from the Barnsley Fuel Company, who are putting down a low-temperature carbonizing plant at the pit mouth. And now the Sheffield Corporation Electricity Committee are divided over the question of a site for a new generating-station One section of the Committee favours the construction of a central station of large capacity in the immediate vicinity of the South Yorkshire coal-fields—the suggested location being at Sprotborough, about three miles from Doncaster, and the centre of the new coal-field. It is thought that this proposal may find favour with a majority of the Committee; but the other section would prefer to have the new generating-station nearer home, and so under closer control. These are all signs of new times in connection with our practices—and more than signs. Some of them are realities, and probably the thin end of the wedge towards larger pit-head concentrations of gas and (if there is present a good supply of water for cooling purposes) electricity producing plants, though with them there comes a point, of geographical birth, at which the transmission of gas or electricity and the transport of the coke and other residuals would not present any economy over the transport of coal for gas production and (from the gas or coke) electricity generation near the place of utilization of the gas and electricity. We have the example of Liverpool and other large cities in going to distant watersheds for their water supplies. However, from these purchases of coke-oven gas for town service, and from what is seen in association with electricity supply, there may issue larger schemes with their roots in the coal-fields.

Research Finance and Fuel Economy.

An announcement of inestimable importance to the future of the industry of this country was made at the end of last week, following the interview that Lord Crewe, President of the Privy Council and of the Committee on Scientific and Industrial Research, had on Friday with a deputation from the Board of Scientific Societies, as reported in our "Miscellaneous News" columns. The intelligence was to the effect that the Government have created a Department of Scientific and Industrial Research; a Royal Charter having been granted to the members of the Privy Council Committee. Through this Department, it is hoped to deal with research in an adequate and encouraging manner—the necessary finance being provided co-operatively. The Treasury, it is understood, have taken a more generous view than hitherto of research requirements, although the exact measure of this generosity is, outside, an unknown quantity. But it is said that they are prepared to set aside a large sum to form the nucleus of the Department's funds, that it will be four or five times as much as has ever before been allocated to such work, and that it will be sufficient to cover expenditure over four or five years. Industries and firms will be asked to contribute to the funds, which is only fair, seeing that they are likely to be the largest direct beneficiaries under the scheme. Whether it will be an encouragement to know that subscriptions will be exempt from income-tax and excess profits tax remains to be seen; but the proposal offers a good channel for the disposal of surplus profits so as to obtain freedom from all questions and trouble arising from excess profits. A further part of the scheme is the formation of Industrial Associations in connection with various industries for the promotion of research, which Associations will work under the supervision of the Department. Every industry, we should imagine, will desire to be associated with a scheme which offers advantage partly at the expense of the public purse, and to have research in connection with its own interests placed upon an extended and scientific basis. It is observed that Lord Crewe intimated that the Advisory Committee of the Privy Council Committee had agreed with the Coal Conservation Committee regarding the establishment of research on a scientific basis, with the view of realizing systematic economy in the use of fuel. This was evidently the scheme foreshadowed by Professor W. A. Bone, at a meeting of the South Wales Institute of Engineers at Cardiff last Friday week, when he said there was some idea that the work of the British Association Committee on Fuel Economy might be taken over by the Scientific and Industrial Research Committee of the Privy Council.

The Juniors and Exemption.

It requires a good deal of perseverance to keep pace with the kaleidoscopic changes in connection with the subject of exemption. In a war such as this, it is easy to appreciate that, circumstances ever altering, it is practically impossible to see far ahead, though it is necessary to provide a good margin in every essential to cover contingencies. Changes have come about in regard to man power which compel the issuing of more stringent instructions to the military tribunals; and an order published last Friday

now narrows down considerably the powers of the tribunals in exempting men under 26 years of age. We do not suppose that there are many men in the gas industry under that age (if medically fit) who, unless absolutely indispensable, are not wearing His Majesty's uniform. There is, of course, the suspicion in certain official quarters that there are still in the industry men who were granted exemptions in the early days of the war who, with the proving of the usefuluess of women labour, could now be done without; but it must not be overlooked—the men responsible for the industry, and for providing a large part of the supply of benzol and toluol for munition purposes, are not likely to overlook it if others are—that the man power of the industry has been so far depleted that one efficient man has now greater value than he ever had before, and that the loss of such a man is not to be counterbalanced by the introduction of unqualified and unpractised assistance. However, the Government has not got its eye specially on the gas industry; but the new resolve incorporates it as well as others. This resolve is that, except in certain special cases, it will not be justifiable for tribunals to grant exemption on the ground of business or employment to any man under 26 years of age who is fit for general service. But there are exceptions; and these will cover men of special qualification in the gas industry. The tribunals may grant exemption when a man belongs to certain skilled occupations of essential national importance, and for which the demand for men is much greater than the supply; they may also do so when a man is engaged on work of high national importance, and possesses special qualifications for the work which make him manifestly irreplaceable. There are a good many such men in the industry; but, as already said, not a great number under 26 years of age.

CALORIFIC STANDARD ACT APPLICATIONS.

Thirteenth Official List.

THE Board of Trade have received applications from the following further Companies for Orders fixing a calorific standard of 500 B.Th.U.

GLOUCESTER GAS LIGHT COMPANY.
TYNEMOUTH GAS COMPANY.
WALKER AND WALLSEND UNION GAS COMPANY.

NATIONAL GAS COUNCIL.

A BUDGET of printed matter to hand from the Secretary (Mr. W. J. Smith) is proof of the fact that the National Gas Council have lost no time in getting to work.

A letter which has been sent from the temporary offices at No. 39, Victoria Street, S.W., to all but the smallest gas undertakings (over the signatures of the Hon. Secretaries, Mr. W. E. Price and Mr. F. W. Goodenough) calls attention to the fact that the Council has been formed, and is now fully organized for the purpose of promoting, and when necessary defending, the interests of the gas industry as a whole. The letter proceeds:

This does not imply that any of the existing organizations in the industry will cease to fulfil their normal functions. Their spheres of usefulness will not be encroached upon; but, as experience has shown, especially during this war, questions of high importance arise from time to time which call for authoritative and co-ordinated action on behalf of the industry as a whole. For this purpose no properly constituted body has previously existed; and it is for this reason that the National Gas Council has been formed. To avoid the possibility of isolated action and lack of co-ordination on matters affecting the interests of all, it is hoped that in future when any such questions arise those who are desirous of action being taken will communicate immediately with this Council, so that the matter may be dealt with through its Committees.

In sending you the enclosed memoranda and form of inquiry, we are desired by the Council to impress upon you the urgent need of the Ministry of Munitions for an increased supply of benzol and toluol, and to point out that, both in regard to the reservation of essential men and the certification of orders for goods and materials, those undertakings which are washing their gas with oil are certain to receive more favourable consideration, and can better count upon assistance from Government Departments, than those only washing with tar.

RECRUITING FROM THE GAS INDUSTRY.

One of the documents enclosed deals as follows with the reservation of essential men from military service, and the proposed further recruiting from the gas industry.

The Institution of Gas Engineers and the British Commercial Gas Association were recently invited by the Board of Trade (Reserved Occupations) Committee to send a joint deputation to discuss with them the need for further recruits for the army, and the proposed revision of the present list of certified occupations, so far as it affects the gas industry. A representative deputation accordingly attended at the Board of Trade on Oct. 12.

The Chairman of the Board of Trade Committee stated that the Man Power Board had called upon them to re-consider the whole list of certified occupations, and that the object of the meeting was to urge upon the gas industry the pressing need for more recruits, and to ascertain in what way exemptions at present granted to employees of gas undertakings could be revised without endangering the supply of gas to the public and of high explosives to the Ministry of Munitions.

It having been pointed out very forcibly by the deputation that there was already such a shortage of labour in the gas industry that there would be great difficulty in keeping up the supply during the winter period of maximum demand, without any further depletion of staffs, and that the industry suffered seriously from the fact that the exemption of men employed by gas undertakings only covered such men as were engaged in the same occupation on or before Aug. 15, 1915, the Board of Trade Committee decided that they would take no action in revising the list of certified occupations, so far as it affects the gas industry, until the spring, but could not at present extend protection to men not in the industry at Aug. 15, 1915.

At the same time, they stated (1) that after the winter it would be imperative that every able-bodied man of military age who could by any possible means be spared from the gas industry should be released for service; (2) that the War Office were establishing machinery for the transfer to essential industries of men employed in non-essential industries who were unfit for military service; and (3) that they were satisfied, from the evidence before them, that there were wide differences between what had been done in some gas undertakings and what had been done in others, in the direction of employing women in place of men, or of training boys, over-age and unfit men, to take the place of men fit for service.

The deputation undertook to bring these points to the notice of the whole industry, and to obtain as much information as possible on the whole subject, for further discussion with the Board of Trade and the Military Authorities. In view of the formation of the National Gas Council, the deputation decided to refer this very important matter to that Council; and a Special Committee has now been set up, consisting of the Executive Committee of the Council, together with such members of the deputation as were not already on that Committee.

To enable them to take the necessary steps for dealing with the matter, the Committee request the earliest and fullest possible reply to a list of questions accompanying this intimation.

CERTIFICATION OF ORDERS.

Another document calls attention to the great and increasing difficulty of obtaining supplies of goods and materials essential to the maintenance and increase of the supply of gas to the public. It is pointed out that the authorities are making every possible effort to secure the enlistment, or the diversion to work on Government contracts exclusively, of men at present engaged in trades supplying metal goods and materials essential to the gas industry. To enable these trades to retain their essential men and to obtain supplies of raw materials from other firms, it is necessary that all orders sent them for execution should be accompanied by a certificate on Form M.M.17, issued by the Ministry of Munitions, for the purpose of securing priority for the work referred to therein. For the purpose of these certificates, work is classified by the Ministry in a manner which is explained.

There are also included a copy of the constitution and rules [see *ante*, p. 405] and a list of officers, and members of Council. The names of the office-bearers and of the General Consultative Committee have already been given in the "JOURNAL" [*ante*, pp. 120, 171]; and it is thus possible now to complete the information, by stating who are the members of

THE EXECUTIVE COMMITTEE.

Mr. D. Milne Watson (*Chairman*)	London
Mr. Thomas Berridge	Leamington
Mr. A. E. Broadberry	Tottenham
Mr. Charles Carpenter, D.Sc. .	London
Mr. Samuel Glover	St. Helens
Mr. F. W. Goodenough . . .	London
Mr. D. H. Helps	Reading
Mr. A. A. Johnston	Brentford
Mr. H. E. Jones	London
Alderman F. S. Phillips . . .	Salford
Mr. W. E. Price	Hampton Court
Sir Hallewell Rogers	Birmingham.

PERSONAL.

Mr. SHAW, who has been engaged at the Shipley Urban District Council Gas-Works, has received the appointment of Manager to the Rothwell (Yorks.) Gas Company.

The position of Engineer and Manager to the Monmouth Gas and Water Company, rendered vacant by the recent death of Mr. Thomas Brace, has been filled by the appointment of his brother, Mr. ISAAC M. BRACE, who has been with the Company for many years.

Mr. H. J. CARPENTER, now Assistant Manager to the Doncaster Corporation Gas Department, was before leaving the Harrow and Stanmore Gas Company presented with a cheque by the Directors, and with a handsome silver cake basket and egg cruet by the Engineer, Manager, and staff.

ELECTRICITY SUPPLY MEMORANDA.

The Fire Hazard "Bugaboo."

For some years we used to interest ourselves in the annual fire reports of London and its environs with the view to analyzing the causes of fire, and which investigation always, without exception, brought us to the conclusion that, in relation to the number of consumers, the proportion of fires caused electrically was considerably greater than those produced by gas. That the experience is not a solitary one, and that London is not electrically wired worse than other places is demonstrated by a compilation made by Mr. Robert Ffrench Pierce, and published in the "American Gaslight Journal." It completely refutes all the claims of the electricians that their commodity is safer than gas. He has collected the reports of the Fire Marshals of ten States—Maine, Massachusetts, Virginia, Ohio, Indiana, Illinois, Michigan, Minnesota, Iowa, and Nebraska; and in twelve months the total number of fires electrically produced was 1616, and of fires gas occasioned 641. How ill-founded is the belief that insurance premiums are accurately proportioned to the probability of fire is also shown; it being a well-known fact that many conditions of demonstrated influence in the causing of fires are ignored altogether in computing the rates to be charged for fire insurance. The figures that Mr. Pierce supplies, and the totals of which we have quoted, indicate that any allegation that electricity is the safer illuminant is altogether devoid of truth. Inasmuch as there are probably at least four gas-meters to each electric meter in the territories represented, the ratios of electric fires to gas fires —1616 to 641, or slightly over 2½ to 1—should be multiplied by at least four, making the actual ratio 10 to 1 based upon equal use. "Like the air-vitiation fallacy," says Mr. Pierce, "the gas-fire hazard bugaboo vanishes into thin air when punctured by an investigation of facts. Moreover, the facts prove the precise opposite of the accepted allegations. Such differences as do exist are altogether in favour of gas; and they are advantages which affect the interests of every gas user."

A Hackneyed Practice.

It seems the Hackney Borough Council, notwithstanding the Long Eaton, the Ilford, and the South London preferential charge cases, have sufficient confidence in the strength of their position in the matter of alleged preferential charging as to make a stand against the Gas Light and Coke Company, who, on their part, are sufficiently confident in their case to issue a writ against the Borough Council. We do not know anything as to the merits of the Borough Council's case. But they and their legal advisers have unquestionably before them the reports of the Long Eaton case in the Lower and the Appeal Courts; they have doubtless also before them an account of the ignominious retreat of the Ilford Council and of a company across the Thames when they came to close quarters with those who sought to cause them to mend their ways, and pursue a statutorily virtuous path. The Gas Light Company are seeking a declaration that the Council are acting in breach of the provisions of the Electric Lighting Act, 1882, in supplying at a lower rate electricity for lighting purposes to persons who take electricity for power than they charge persons who take current for lighting purposes only. If this is the plain fact, we are entitled, without influencing the judgment of any Law Court, to regard the lighting-power consumer as being in a better monetary position in regard to lighting than the man who uses current to an equal extent for the one purpose of lighting. The Gas Light Company also apply for an injunction to restrain the Council from making any such differentiation. There is the promise here of a little fight; but there is precedent for the collapse of such cases, and perhaps, if wise counsels prevail, this one will follow precedent. We cannot say; but the issue is a simple one, and should not require much argument.

American Cooking Investigations.

In the account of the proceedings of the American Gas Institute in the "Journal" last week, some information was given as to an investigation that Messrs. S. C. Bratton and G. D. Mantle had made in relation to gas and electric cooking under American conditions; and in all cases gas came out on top in point of economy—we repeat under American conditions. The gas-ranges used were of American build. We have not seen a typical American gas-range of recent date, so as to compare its points with the latest productions at home. But in placing a value upon the figures advanced, the fact must be borne in mind that they were obtained with American productions; and it may be that in the States more exacting attention is given to electric-cooker construction than to gas-cooker. Then the investigators take another condition that is not commonly in accordance with its like here. They price gas at 4s. 2d. per 1000 cubic feet, and electricity at 1½d. per kilowatt hour. The great bulk of gas in London is sold in normal times for lighting, cooking, and heating alike at from 2s. 2d. to 2s. 6d. per 1000 cubic feet—nearly half the price adopted for gas in the investigation. On the other hand, it is (again in normal times) a very ordinary thing to find electricity for cooking and heating sold here at 1d. per unit. The figures obtained from the comparison reveal a saving of more than 60 per cent. in favour of gas. The modern electric oven used is credited with a thermal efficiency of 76 per cent.; and the ovens of the gas ranges used showed an efficiency of only 30 per cent. We are assured that the efficiency tests were carefully made and checked. But there is no indication as to the method applied; and there are so many pitfalls in the testing of oven efficiency, and so many varieties of ovens, that the ascribed efficiencies must not be taken as universally applicable. But under those conditions electricity at 3 c. per kilowatt hour was found incapable of attaining equality in cost with gas until the latter reached $2·08 per 1000 cubic feet. That is bad—especially when compared with the much lower prices for the bulk of the gas sold in England. But whatever the efficiency of the American electric ovens, that of the hot-plates attached to those or any other electric oven is abominably low. They cannot help it. It is the state to which they are born; but the disagreeable part of it for them is that so much of the culinary work is done on the hot-plates. Taking the same prices, the investigators found that the cost of heating one pint of water electrically found its equivalent in gas at $6·65 per 1000 cubic feet (or nearly 28s. per 1000 cubic feet), one quart of water in gas at $5·15, and two quarts of water in gas at $4·44. The electricity consumptions were respectively 253, 359, and 534 watts, and the gas consumptions 1·2, 2·2, 3·8 cubic feet of 600 B.Th.U. gas. The best efficiency was realized with the two quarts of water; but finding an equality with gas at $4·44! The cost of the electricity used in this one small operation at 3 c. was upwards of ¾d., while the cost of gas at $1 was slightly less than 0·2d. The time occupied in boiling one pint of water electrically was 12 min., and with gas 3 min. 10 sec.; the two quarts of water took 25 min. with electricity, and 9 min. 24 sec. with gas. In household work, as in other work, time economy is important as well as money.

Home Truths.

The investigators make, in the full text of their paper, comment upon the futility of comparing the bills of similar sized households in order to adjudge the relative costs of gas and electricity. The figures, in their opinion, are unreliable "owing to the fact that the average user of an electric range is so thoroughly impressed with the fact that it is necessary to be economical that she does not use it to nearly the extent that the average gas consumer uses hers." But that is not the only reason. Householders differ one from the other in the matter of quantity and kind of cooking; and the habits and requirements of even a single household undergo many changes. Thus we sometimes get the anomaly in comparisons of electrical origin that, if there was equality in the amount of work done, the efficiency of the electric-cooker on the consumption of electricity would be considerably more than 100 per cent. But Messrs. Bratton and Mantle are quite persuaded that owners of electric-cookers are afraid, on account of high cost, to supply them with the same freedom as they had previously done their gas-cookers. This, they say, is borne out not only by comparing the average bills from five apartment houses situated in Great Falls and Anaconda, Montana, Salt Lake City (Utah), and Portland (Oregon), but by the opinions of the users themselves; for from all these cities come reports of dissatisfied consumers complaining of slow cooking and high bills. There ought to be some compensation for the high bills; but the consumers fail to find it in their practical experience. The result of this is still more convincing of discontent. With one exception, in the apartment houses subsequently built, the same owners had returned to gas-ranges; and, in the case of the exception, the wiring and ranges were furnished free by the electric company—a policy which the gas company concerned did not see their way to adopt. To have to supply for nothing such expensive appliances as electric ranges, together with the wiring, to capture business at 3 c. per unit does not suggest to us a profitable proposition; but electricians will do strange things to make some sort of showing in this cooking business with low-priced units and intermittent and comparatively small operations.

The Charge and the Circumstances.

The foregoing practical experience as to the discontent of users of electric-cookers in America, and as to a return to gas-cookers in newly erected apartment dwellings, comes appropriately as a reply to articles by Mr. H. O. Swoboda, in the "Electrical Review" of Chicago, for anyone would think reading them that, now that heating elements are better than of old, and charges for current for cooking have been forced-down by the relative cheapness of other fuels (though electrical initial prices, maintenance, unreliability, and time-wasting uphold their reputation), the supremacy of electric operation in the kitchen is assured. It is not. A faster adoption of electric-cookers would have been experienced had all been well with them —economically and otherwise. Mr. Swoboda also refers to 3 c., or 1½d., per unit as being quite a common charge in America for current for cooking; and he admits that this price cannot compare with the rates available in a number of districts in Great Britain. The "Electrical Times" rather thinks that Mr. Swoboda cannot have heard of that electrically famous body the Point-Fives; for he quotes 1d. as the minimum tariff obtainable in English towns. Our contemporary concedes the probability of 1d. being the average rate over here; but it says there are upwards of two dozen undertakings that in normal times give a supply for heating and cooking at ½d. per unit. That is not so. The majority of these undertakings charge a heavy lump sum on the rateable value of the premises supplied, *plus* the ½d. per unit. The lump sum has to be averaged over the total consumption. Otherwise, if it is held to apply to lighting only, then cooking is being charged at a flat-rate of ½d. per unit; and if the undertaking is not prepared to

supply other consumers for cooking at a flat-rate of ½d., then they are showing undue preference in the charge for cooking to those consumers who pay a lump sum for lighting *plus* ½d. per unit. The Courts have held that a consumer (say) for power must not because he is a lighting consumer be given a preferential charge over another consumer for power who is not a user of current for lighting. Another point made by the "Electrical Times" is this: "That any great development of electric cooking can be expected in the States with tariffs that are seldom, if ever, less than 1½d., points to a firm conviction on the part of American electrical men that the public will be prepared to pay what seems a prohibitive figure to English minds for the 'advantages' of electricity in the kitchen." Our contemporary overlooks the fact that gas in this country is much cheaper than in America. The 1½d. per unit in America contrasts with gas at (say) 4s. 2d.; while the "average" 1d. in this country compares in normal times with gas at 2s. 6d. per 1000 cubic feet. Which then is the more prohibitive in the circumstances—the 1½d. or the 1d.?

Questions for Mr. Nobbs.

Mr. C. G. Nobbs has just recently been lecturing on electric cooking at the Falkirk Iron-Works. He dealt with that singularly amusing piece of bluff as to the loss of "meat." He stated that the loss is only some 11¾ per cent. with electric cooking, as compared with 25 to 33 per cent. with gas or coal cooking. Will Mr. Nobbs kindly inform us the name of the gas range that he personally used in ascertaining this loss of "meat;" the temperature employed in it; and, if the temperature was higher than in the electric cooker, why was it so, if the temperature in the latter sufficed to cook the meat to the degree required by the owner?

GAS FOR INDUSTRIAL FURNACES.

Important Demonstrations at Manchester.

By the courtesy of the Chairman (Alderman William Kay, J.P.) and members of the Manchester Corporation Gas Committee, a large company of technical experts and representatives of the leading armament and engineering firms in the Manchester district, including controlled establishments and certified undertakings, together with a number of eminent engineers, was enabled on Friday last to witness further practical demonstrations of the value and utility of gas in the heat treatment of metals for the manufacture of munitions of war, and for other industrial processes, at the Whitworth Street West meter-stores of the Department. About three hundred invitations had been issued to users and non-users of gas by the Superintendent of the Department (Mr. Fredk. A. Price); the most satisfactory and encouraging feature of the exhibition being the recognition by the hard-headed, shrewd, and practical heads of departments and skilled artizans of the present and future possibilities of the use of gas for all industrial purposes. This was clearly evidenced by the number of questions addressed by the visitors to Mr. Cyril G. Davis, of the Davis Furnace Company, Luton (whose furnaces and other specialities were seen in actual work), and to Mr. W. R. Twigg, the Technical Manager of the Company, and half-a-dozen expert assistants.

During the course of the afternoon, Alderman Kay announced that the exhibition would remain open until Dec. 21, from 9.30 a.m. to 5 p.m., and that manufacturers would not only be able to see any kind of gas appliance in actual work, but would be cordially encouraged to test any of the furnaces for themselves by their own staff of workmen, with their own material, and under their own conditions.

Alderman Kay, in the course of a brief speech of welcome to the visitors, said he was sure that no apology was needed for asking them to attend that afternoon. The Manchester Gas Committee had always been mindful of the interests of their consumers, both small and large; and he felt that it was their duty to be so inclined. Therefore, as the gas suppliers of the Manchester district, they deemed it their duty to invite manufacturers and others to see actually working some of the latest types of gas-heated furnaces that were adaptable for many of the industrial processes carried on in the city. The Committee desired on all occasions to be as helpful as they possibly could to their consumers in these very difficult times. Referring to the necessity of manufacturers paying close attention to efficiency and economy in production, he said that by the use of gas for industrial purposes complete control of the temperature of the furnaces in which the processes were carried out was secured. Workmen were thus able to maintain within the furnaces the precise atmospheric conditions necessitated by the process in operation. These factors made for economy. Therefore, he believed that by organizing demonstrations such as the present, they were assisting in the work of the nation. If gas had not been available for the purposes of the war, the country would, he was afraid, have been in very sore straits for munitions. A number of complaints had appeared of late in the local Press regarding the quality of Manchester gas. He asked those present to bear in mind that the gas undertaking was playing an important part in the supply of bye-products for the manufacture of high explosives, in addition to which they contributed several thousands of pounds a year to relieve the rates. The people could not have the cake and the halfpenny as well. Nevertheless, had it not been for the war they would have very seriously considered a revision of the scale of charges of gas for all purposes—indeed, it was hoped to reduce the scale of charges for large consumers (graduated according to scale) in the near future. He assured them that the Gas Committee were desirous to give the very best service possible, as it was now almost everywhere recognized that gas as a fuel had been the means of dispensing with much arduous and unhealthy labour, and of obviating the pollution of the atmosphere which generally resulted from the use of coal and coke-fired furnaces. From the standpoint of its utility, there was nothing he could add to what must be apparent to any careful or thoughtful man. With gaseous fuel there was no coal supply to think about; no transport or haulage difficulties; no fires to be clinkered nor ashes to be carried; and great economy of space, in that no coal-stores or ash heaps had to be provided for. On the other hand, the mains were laid direct to the factory or workshop door, and the supply was always available; so that the furnaces could be brought into operation almost at a moment's notice. He made an earnest appeal to those present to embrace the opportunity of testing the furnaces for their own particular requirements under their own conditions—adding that it was the intention of the Gas Committee to adapt as early as possible a portion of the Whitworth Street West meter-stores as a permanent show-room fitted with high-pressure gas for the purpose of enabling manufacturers of appliances to have the ready facility of showing to their consumers the furnaces in actual working order.

Gas Undertakings and the War.

Mr. Cyril Davis, in proposing a vote of thanks to Alderman Kay, said it afforded him particular pleasure to do so, because that gentleman might be termed one of the "live" men of the gas industry who was always anxious to encourage and support progress. Evidence of this was seen in the manner that the Corporation had entered into the furnace department. Practical demonstration was surely the very best method of carrying conviction. With this idea, the principal gas-furnace firms had been invited to Manchester to give practical illustrations of the progress that had been made, more especially since the outbreak of war, in the scientific application of gas for industrial purposes. The Gas Department were not only enterprising enough to invite the leading appliance manufacturers to the city, but they were also about to open a furnace department of their own, under the supervision of Mr. Barrett—a man of great ability and experience and practical knowledge. Gas had undoubtedly played a very important part in the conduct of the war. The last speaker had alluded to the prominent part taken by the gas undertakings of the country in supplying the products required for munitions; and it was largely due to these efforts that our supplies of munitions were so satisfactory to-day. There was hardly a town in this country where munitions were being manufactured that gas-furnaces were not being used in some form or other. This, however, was only one of the directions in which gas was playing its part; there were many others which he need not enumerate there.

Alderman Richard Birtles, the Deputy-Chairman of the Bradford Road Gas-Works, who seconded the vote, paid a tribute to Alderman Kay's whole-hearted interest in the working of the gas undertaking. He had displayed a good deal of anxiety in the development of the furnace department, and had given it enthusiastic support from its inception.

Alderman Kay briefly returned thanks.

Mr. W. R. Twigg afterwards gave a technical demonstration of the appliances on view; a large number of the visitors remaining until a late hour to watch the experiments.

DEMPSTER-TOOGOOD CONTINUOUS RETORTS AT OLDHAM.

The Westinghouse Gas-Engine Installation.

In connection with the million cubic feet of gas per 24 hours Dempster-Toogood continuous vertical retort plant, which has been erected at the Oldham Corporation Gas-Works by Messrs. Robert Dempster and Sons, Limited, of Elland, under the supervision of the Engineer (Mr. T. Duxbury), there is an installation of Westinghouse gas-engines, the special grouping of which is a feature of interest. There are three engines, with mechanical driving; and in adopting this principle, arrangements have been made to secure the maximum of combination, and to eliminate, as far as possible, any likelihood of a stoppage of the working of the plant.

This is explained in an article appearing in the "British Westinghouse Gazette," by Mr. J. G. Walthew, who says the Gas Engineer has proceeded directly to obtain maximum economy, by using gas-engines with mechanical driving. The power plant consists of two Westinghouse horizontal town-gas engines, of the industrial type, each 34 B.H.P. capacity at 250 R.P.M., and one 6 B.H.P. town-gas engine at 300 R.P.M. Each of the engines can be used to maintain continuity of motion to the mechanical coke-extractors, upon which depends the process of gas manufacture, and consequently the lighting of the town. Each can be used in turn to act as starter to the others. This is specially useful, taking into consideration that one or other of the engines must operate continuously day and night. Either of the two larger engines can be employed for driving the coal-elevator, the mechanical hoist, and coke-extractor, all working in combination. The smaller engine drives the coke-extractor only when the coal-elevator and hoist are not required.

These advantages are secured by coupling the gas-engines by means of belts to one common line-shaft arranged overhead, and providing suitable fast-and-loose pulleys and a jaw coupling. To provide against any failure in operation—supposing the line-shaft should give trouble, or a bearing seize—the small gas-engine has an independent drive to the coke-extracting gear. This arrangement also permits of the line-shaft being stopped at night, or whenever the other engines are not required. The jaw coupling upon the line-shaft is fixed at an intermediate point between the drive to the coal-elevator and the drive to the hoist; so that, by

withdrawing the coupling, each drive is independent—one engine for the hoist, another for the coal-elevator, and the third for the coke-extractor. In this way, the maximum safeguard against breakdown is perfectly assured, in addition to providing every facility for stopping any portion of the power plant for inspection and overhauling.

Commenting upon the installation, Mr. Walthew remarks: When comparing gas-engines and mechanical driving with electric driving, one is bound to admit that the same degree of flexibility is not always obtainable; but electric driving can be purchased very dearly upon occasions. At the Oldham Gas-Works, the general compactness and grouping of the plant conforms with ease to the requirements for mechanical driving; so that for any loss in regard to flexibility, ample compensation is provided by duplicating the drives, and by the added economy obtained in using gas-engines operating from town gas at cost price. One of the additional advantages claimed for electric driving is a quick start possible. But, as will be observed, in this particular application, as any one gas-engine can be used for starting-up either of the other engines, this claim is disposed of. When overall economy is fully considered, the gas-engine with mechanical driving will be found to represent, in almost every case, the cheapest means of power for gas-works, taking into account the following economic principle: Gas-works in the modern sense are chemical works, depending not altogether upon the quantity of gas produced, but on the "throughput" of coal. Hence, if gas is used for power purposes at the gas-works, it is obtained at first cost, saving all distribution charges, while the "throughput" of coal is augmented, with corresponding increase to the volume of residuals.

AMERICAN GAS INSTITUTE MEETING.

The Remaining Papers.

BEYOND the papers that were noticed in the last two issues of the "JOURNAL," there are the contributions to the Illuminating Section and the Accounting Section to be dealt with.

ILLUMINATING SECTION.

Of the three papers that were to be presented to this section, only two have up to the present come to hand. One of these, by Mr. T. J. Litle, jun., is on "Gas Ignition," and in it are discussed and illustrated the various types of igniters in use. The ignition problem in connection with the gas-engine is, the author remarks, very similar to that of the gas-burner used for purposes of illumination; and while the problem might seem to be more difficult in the gas-engine, on account of the highly compressed charge of gas and air, it must be remembered that it is possible in the case of a gas-engine to supply a very complete equipment representing a considerable investment, whereas this would not be generally feasible in the case of the gas-lamp, and a device costing as much as, or more than, the burner itself must of necessity have a limited sale and use. The great problem, therefore, to be solved is the provision of some inexpensive and reliable method of ignition. While the pilot is the oldest form of self-contained gas-burner igniter, it is still the most used, and has always been the most popular method of ignition, due probably to the fact of its great simplicity and inexpensive construction.

The various systems of electric ignition are described in the paper, and then the more important types of catalytic devices, and the pyrophoric alloy invented by Dr. Welsbach. Strangely enough, says Mr. Litle, the most recent type of igniter is in the pilot-class. A great deal of research work has been carried out with the object of making pilot-flames withstand a high draught. Various kinds of protecting boxes and cages have been devised; but, while they protect the pilot to some extent, they cannot very well be adapted to the small residential burner. Experiments were conducted with the idea of using a catalytic material to re-light the pilot-flame in case it should be accidentally extinguished; but this did not prove satisfactory. In the course of the experiments, however, a pilot was designed in which a bundle of rare-earth filaments was placed around the mouth of the pilot-tip, completely covering the flame. It was found that a surprisingly small amount of gas was required to bring the entire bundle of several thousand filaments to a bright incandescence—combustion seeming to take place throughout the mass. The most important feature in connection with this new development is the fact that the glowing mass cannot be blown out by the strong draughts which ordinarily extinguish pilot-flames. In a stiff breeze, the mass will be cooled down below the incandescent point on the windward side, but be found to be glowing brightly on the leeward side. After the draught has subsided, the entire mass quickly re-kindles. Other points are that this lighter consumes much less gas than does the open-flame pilot, and that the glowing mass furnishes sufficient illumination at night to enable a person not only to locate the lamp in the dark, but to distinguish articles of furniture, &c.

Mr. C. A. Luther detailed "Chicago's Experience with a Separate Lighting Division"—an arrangement which he regards as specially necessary where there is contention between the gas and electric interests to secure the business patronage of the prospective consumers by offering more advantageous equipment as an inducement to secure their custom. Regarding the lighting business as one of the most important branches, he sees no reason why gas undertakings should not have a special force of men who are thoroughly drilled into knowing what is the proper type of lighting unit to use for the different classes of service, and the correct methods of spacing and installation, and who can also converse instructively with the prospective consumer on all technical matters pertaining to illumination.

The number of men in a lighting division will naturally be governed by the size of the company, the area and population of the city, and the ability of the division to secure the desired end. As a matter of fact, exceptional results are being obtained in Chicago from a division consisting of a manager, two assistants, two special men to follow up lamp removal orders, three supervisors, the necessary salesmen, and a clerk. There is a general meeting-room, where all the men report twice a week, and here a large blackboard has been fixed extending across the front wall of the room. On this board is kept a record of each man's daily report of the amount of lamp business he secures. It has been found that this plan has acted as an incentive for the men to do more work, as the board stares them in the face at every meeting. The city is divided into three districts—each under a supervisor, who has from eleven to thirteen men under him.

Great attention is paid to educating the men to become lighting experts. Each man is given a course in illuminating engineering compiled by the Company; and there are periodical meetings, at which free discussion takes place on all phases of the lighting business. In addition, each man is provided with a loose-leaf handbook which is supplied from time to time with blue-print sheets dealing with different points about their daily work. These blue prints have been of considerable benefit in helping the salesmen to secure business.

Some two years ago, the Company realized the necessity of producing a unit that would allow the public to accurately compare all shades of silk, cloth, &c., and at the same time afford a general distribution of light; and the result was the introduction of the "daylight gas-arc," scientifically evolved, with glassware and mantles which give practically the same balance of red, yellow, green, blue, and violet rays as are found in daylight. Over 8000 of these lamps have already been installed. Special reflectors are also supplied by the Company for studios, art galleries, and places of that kind. Then, again, a special feature is made of gas-arc signs, each lamp having a single letter attached to the globe, and any desired word being spelt out by hanging the necessary number of lamps in a row. The scheme of installing these gas-arc signs was started in July last year, and already over 900 three-mantle inverted arcs have been fixed for long-hour consumers in this way which would not otherwise have been needed. The lamps are suspended from a 1¼-inch iron pipe bracket which is braced by chains—these being found the best type of support. A number of photographs of installations of these signs, and of the other specialities referred to, accompany the paper.

ACCOUNTING SECTION.

Mention was made in the programme of a paper on "Cost Records on Installations;" but if it was submitted, a copy does not appear to have yet reached this side. There was a contribution by Mr. F. H. Patterson, on "Organizing for Cost Reduction in the Consumers' Book-Keeping Department." It seems that the business of the Rochester Railway and Light Company is becoming larger and more complex as the years go by; and this brought about the need for a revision of the methods employed in the department referred to. There are upwards of 70,000 gas accounts, of which 14,000 are on the prepayment system; and a curious point about this is the statement that the prepayment gas-meters are being systematically withdrawn from service, and regular meters substituted for them.

The first step was the organization of a continuous meter-reading plan by districts—one district a day for twenty-two days, thus permitting the work to flow into the book-keeping department daily in amounts possible to dispose of within the day. As a continuous collection plan automatically follows continuous meter reading, the work of the department was immediately reduced to a daily basis, thereby disposing almost entirely of overtime work. The plan embraced the organization of the employees of the department into groups governed by the nature of the work performed; the combination of separate but related activities within groups; and the specialization of functions within groups, with the object of comparing the results of the work of individuals, thereby learning the efficiency of each. This latter requirement would naturally have as its corollary the government of proper remuneration, eligibility for promotion, or other benefits based on the actual merits of each employee. The department was divided into eighteen groups, according to the nature of the work carried out. The duties of each group are explained in the paper; and under the "Regular Ledger Keepers," a point to be noted is that the posting of cash is done exclusively at night, by a corps of employees who report for duty at midnight and work until 8 a.m., except Saturdays, when the hours are from 2 to 6 p.m. One of the groups is the "Relief Group," the supervisor of which has under his authority a sufficient number of employees to supply vacancies in any of the other groups.

At the back of each ledger a sheet, ruled in columnar form, has been inserted, having as captions the names of the various functions necessary for writing-up and balancing a ledger. As each employee completes a piece of work, he is required to turn to this sheet and insert his initials and date of completion of the work under the appropriate caption. In this manner, errors afterwards discovered can be traced to the employees making them. This

automatically provides the merit system by which employees shall receive consideration at various times. The innovations referred to in the paper have been planned largely with the object of eliminating overtime pay; and the results achieved in this direction are stated to be most gratifying.

There was furnished by Mr. Robert Blair an "Outline of the Credit System in Operation by the People's Gas Light and Coke Company of Chicago." Several years ago, the Company required their customers to furnish satisfactory credit information before turning on the supply of gas; and they also required the customer's signature to an application. With the growth of the city, however, greater facilities were called for; and the use of branch stores and the telephone was found to much expedite the service. Last year, indeed, the Company received 45 per cent. of all applications for gas by telephone, and 26 per cent. at branch stores. On a gas supply being requested by telephone, a regular set of credit questions are asked; but the gas is turned on at the earliest possible moment, and investigation is made with regard to credit information at some later period. When the applications reach the credit department (after the gas has been turned on), they are separated into two classes—previous and new consumers—and the necessary investigation is, in accordance with the scheme, set on foot. When matters have been gone into, and for any reason a deposit is deemed necessary to secure the payment of bills, a letter is sent to the customer to the effect that under the Company's rules a deposit will be required as continuing security for the payment of gas bills, and that on a certain day (which is usually forty-eight hours from the date of the letter), the collector will call for the deposit. Upon failure to collect, a final notice is served, which expires in forty-eight hours. If the terms of this notice are not complied with, the supply of gas is discontinued. The entire operation from the inception of the application to a point where the gas is discontinued covers an average period of ten days. Experience and statistics show that the losses sustained where gas has to be finally shut off are proportionately very small compared with the benefits received by the large number of customers who desire prompt service, and whose standing in the community entitles them to it. The Company also accept guarantees in lieu of cash deposits from customers of theirs who have established accounts in good standing, and who are willing to act as guarantors. In 1915, deposits were demanded in only 8181 cases out of a total of 311,324 applications for gas; and of these 1672 demands were cancelled, leaving 6509. These were all among the new customers making application, who totalled 62,116; so that of the new customers making application during the year, 10·5 per cent. were required to pay deposits.

"The Bulletin System as a Means of Instructing Employees" was drawn attention to in a paper by Mr. C. S. Ritter, who urged it as a way of presenting to a company's workers in an effective manner the policy of the management and details of the business. Verbal instructions and meetings of employees are insufficient by themselves; and printed books of instructions are also inadequate, because some of the rules they contain usually become obsolete before the ink with which they are printed gets dry. The psychological time to get the attention of employees and impress them with the needful information is, maintains the author, when the subject-matter presented is pertinent to the conditions at hand. For instance, men should learn about "freeze offs" in winter, when they are having experience with the trouble. The instructions prepared then should become a matter of record, to be preserved in such a form that the next time the same trouble occurs they may be used again. Whatever may be the system used for this purpose, however, it must be sufficiently flexible to allow of rules being amended or cancelled on very short notice. The bulletin system, augmented by departmental meetings, seems to him to answer the purpose very well indeed. The bulletins are printed on convenient-sized paper, and arranged for binding in such a manner that they may be easy to refer to. Much of their success depends upon proper classification and accessibility; and the employee's signature on them will prevent any claim that he had never received the instructions given. At the end of the paper there are reproduced a number of bulletins selected from over 270 which have been issued in the course of ten years.

There is a "Merit System" in operation among the employees of the fitting department of the Consolidated Gas Company of New York and affiliated Companies in the boroughs of Manhattan and the Bronx; and its working was explained by Mr. William D. Kelley, General Superintendent. The employees of the fitting department do all the Company's work on consumers' premises, from the head of the service to the point where the gas is consumed. It is impossible to have the fitters and their helpers under the supervision of a foreman or superintendent at all times, or even for a very small percentage of the working day, scattered as they are over the entire city, except at a cost out of ratio to the result obtained. Thus there is no alternative but to leave them largely to their own resources; and the amount of work done depends solely upon a man's fitness, honesty, and industry, and his sense of fairness to the Company. It was therefore with the twofold purpose of creating an accurate standard, helpful in appraising a man's worth, and of encouraging the men in the faithful and intelligent performance of their duties and benefiting them according to their deserts, that the merit system was inaugurated. Cash prizes are awarded half yearly to the men with the best records; and also any increases in pay depend in a measure on their standing in the merit system. This system considers only the quality of the work done, and in no way the quantity.

A specific number of demerits are imposed for various infractions of the rules, and for improper or unsatisfactory work, as well as for incomplete or incorrect reports. Against these demerits, four credits are given for a month's perfect work—that is, a month without demerits. The credits balance or cancel a like number of demerits, which allows a man to improve his standing by good work. This is a very important feature of the system, as it encourages a man to strive for a perfect month, in order to better a previous month's standing, and prevents the employee from becoming disheartened due to a poor start. The standing of the men is posted in the different shops at the end of each month. The number of demerits imposed ranges from 1 for a slight clerical error to 15 for the more serious offences—those omissions of duty which would entail loss to the Company and cause annoyance or inconvenience to the consumer. Serious offences which warrant discharge are not considered in this system. For less serious infractions of rules, an employee may be laid off for a time. He then ceases to participate in the semi-annual competition, but is eligible for the next period. The system is adjusted to harmonize with the School of Instruction—which is the training ground of the Company's fitters, who are naturally in preparatory and progressive stages of advancement. Both employers and employed vote the merit system a success.

RISE AND DEVELOPMENT OF BYE-PRODUCT COKING.—VII.*

[COMMUNICATED.]

Recovery of Benzol from Coke-Oven Gas.

THE majority of bye-product coke-ovens in this country and also in Germany are arranged for the recovery of the benzol from the coke-oven gas. It is only in connection with those installations which supply coke-oven gas for town lighting purposes that, prior to the war, the benzol was not extracted, on account of the fact that its removal renders the gas-flame almost non-luminous.

The quantity of benzol obtainable differs, of course, according to the nature of the coal. In South Yorkshire, Derbyshire, the Midlands, and Cumberland, the yield from modern plants is about 2½ to 3 gallons of crude spirit per ton of coal; in Durham, it is about to 2 to 2½ gallons; while in South Wales it is generally less than 2 gallons. It will be seen, therefore, that the recovery of benzol will have a different effect on the calorific value of the coal gas according to the locality where the plant is situated. Generally speaking, however, the recovery of benzol entails a diminution in the calorific value of the gas of about 5 to 8 per cent. In most cases, crude benzol only is produced at coke-oven plants, as until quite recent times the demand was principally for this class of spirit. During the year 1912, a strong effort was made to popularize the use of benzol for use as a motor spirit in place of petrol. For this purpose, of course, purified benzol had to be used; and the demand for rectified spirit, or washed 90 per cent. benzol as it is termed, has grown very considerably. As a consequence of this increasing demand, quite a number of benzol rectification plants have been erected during the past few years.

The idea of the recovery of benzol from coal gas originated in 1859, when it was proved that a heavy liquid hydrocarbon could be washed out of coal gas by means of tar oils. Prior to that time coal tar had been the only source of benzol, and much interest was therefore aroused at the new discovery. In 1869, an English patent was taken out by three Germans, Caro, Klemm, and Engelhorn, for a method of benzol recovery founded on the above discovery; but it was not until 1884 that a patent granted to Carvès was actually put into practice. Carvès used washers filled with quartz pebbles, through which the gas passed, meeting tar oil flowing in a counter stream. The enriched oil so obtained was then distilled and the benzol recovered. The modern systems of benzol recovery follow out exactly this principle, differing only from it in that the apparatus for carrying out the various operations has been considerably improved and rendered more efficient. It has been suggested—and patents have been taken out for the purpose—that the benzol might be recovered from the gas by a system of refrigeration. Such processes have not yet been found to be practicable on a commercial scale, largely on account of their high cost.

The difference between the various systems of benzol recovery now adopted in this country lies only in the internal arrangements of the apparatus employed; the principles involved being exactly the same in every case. The benzol is recovered from the gas after the tar and ammonia have been removed. It is necessary that the temperature of the gas after the removal of tar and ammonia should be reduced to approximately that of the atmosphere, thereby reducing the vapour tension of the benzol as much as possible, and permitting of its efficient extraction. In cases where indirect ammonia recovery processes are in operation, this temperature is already attained after the gas leaves the scrubbers. With direct processes, however, the gas leaves the saturator at a temperature of 40° to 80° C., according to the system. It is therefore necessary to cool the gas down to about 25° C. This is done either by direct cooling by means of water sprays or by

* For previous articles of the series, see *ante*, pp. 126, 174, 291, 336, 389.

indirect air or water coolers. The cooled gas then enters a series of scrubbers in which it is submitted to the solvent action of creosote oil—a product of tar distillation. Two or three scrubbers are usually employed; it being arranged that in the last scrubber the gas comes into contact with fresh oil containing no benzol, so that the solvent action is more efficient than it would be if partially saturated creosote were employed.

The usual form of scrubber is a tower packed with boards, thus ensuring an even distribution of the oil and giving a large area for contact of gas and solvent. In some cases, however, rotary scrubbers are employed. These consist of a cylindrical vessel inside of which a shaft with radial arms carrying brushes slowly rotates; the brushes dipping into the creosote oil at each revolution, thereby offering a large and fresh surface for contact with the gas. There is little to choose in the efficiency of the two systems. The enriched oil from the scrubbers, and containing the benzol, passes to a storage tank ready for conveyance to the distilling apparatus as required. It is first pumped into a preliminary heater, and its temperature raised to about 60° C. by benzol and steam vapours escaping from the still. In this way an exchange of heat is brought about; the temperature of the latter products being reduced.

From the preliminary heater the rich oil travels to another heat exchanger, where it is further preheated to a temperature of about 100° C. by means of the hot debenzolized wash-oil issuing from the still. It is then finally heated to a temperature of about 135° C. by means of live steam. In this way, the water is driven off from the oil, together with the benzol and toluol, &c. The mixture of vapours passes from the still through the heat exchanger already referred to, and hence is cooled down and condensed to the liquid state. The condensates flow into the separator, where, on account of the different specific gravities of the benzol and the water, the two separate into distinct layers and can be run off as required. The benzol so obtained is known as crude spirit; and if the process of manufacture is to be carried any further on this plant, a strength of 65 per cent. is usually manufactured. [By 65 per cent. benzol is meant that 65 per cent. of the product would distil over below a temperature of 120° C.]

The wash-oil, now freed from benzol, leaves the still, and also passes through a heat exchanger, and is finally cooled by passing through a tubular cooler until it attains atmospheric temperature and can again be used for scrubbing purposes. In order to produce rectified benzol, various purification processes have to be carried out. The crude benzol is first run into a large lead-lined vessel, which contains a centrifugal mixing device. Sulphuric acid is then added to the benzol, and the mixing device set to work for about half an hour. The mixture is then allowed to settle; the acid going to the bottom of the agitator. The acid removes from the benzol unsaturated hydrocarbons, phenols, olefines, &c., which form thick resinous compounds with the acid, and sink to the bottom of the agitator. The acid having been run off, caustic soda is mixed with the benzol in the same way, allowed to settle, and again drawn off—thus neutralizing any acid which may be left in the benzol. The latter is then washed finally with clean water, in order to remove all traces of caustic soda. The benzol is now ready for fractional distillation.

During the washing process there is, of course, a considerable amount of loss of benzol, varying according to the nature of the crude spirit, but averaging generally between 10 and 20 per cent. of the original spirit. The washed benzol is now subjected to re-distillation in large stills having fractionating columns; and in this way 90 or 100 per cent. benzol is produced. Again, a certain proportion of the spirit remains behind in the still, being composed of constituents having a higher boiling point than that of the benzol. The fraction remaining in the stills after re-distillation usually contains a considerable amount of naphthalene; and the residue from the still is run off after each distillation into open pans, the naphthalene settles out, is brought to a centrifugal machine, and dried. The oily matter remaining is run back into the wash-oil and is used for scrubbing purposes. The sulphuric acid used for washing the crude spirit after a time becomes so saturated with hydrocarbons that it can no longer be employed. It is then run into lead-lined pots and heated by a current of live steam. The hydrocarbons are driven off, and the cleaned acid is then used in the saturator for the manufacture of sulphate of ammonia.

Modern benzol plants are so arranged as to run on very economical lines, owing to the various systems of heat conservation by means of the heat exchangers referred to. The manufacture of benzol is a comparatively simple operation; but it is necessary, in order to produce the best results, to have the plant under the control of a competent chemist. It is much to be deplored that in this country so little attention has been paid to the scientific control of manufacturing operations in general and bye-product coking in particular. In so many instances do we find that haphazard testing only is carried out, instead of that systematic control which tends to check all shortcomings.

For the satisfactory working of a benzol plant, the following are perhaps the principal features of importance which need to be attended to; but it must not be imagined that anything which is not mentioned here is deemed by the writer not to be worthy of attention. It is absolutely essential that a good quality of scrubbing oil should be used for absorption purposes. A satisfactory specification suitable for the particular conditions can be found by experience, and, once attained, it should be insisted upon. Each consignment of fresh oil should be tested, and any differing greatly from the standard specified should be rejected. It is only by vigorous adherence to a suitable quality of oil that the best results can be obtained. The following is a good average specification of coal tar creosote:

Oil to have a specific gravity of 1·030 to 1·050 at 60° Fahr.
On distilling, none should come off below 200° C.
Distillate below 230° C., 18 to 25 per cent.
,, 230° to 280° C., 50 to 60 per cent.
,, 280° to 300° C., 5 to 10 per cent.
Residue left at 300° C. should not exceed 10 per cent.
Naphthalene deposited in all the fractions should not exceed 12 per cent. on standing twenty-four hours.

On some plants, blast-furnace creosote is used with success. This possesses one advantage, in that it contains no naphthalene. The following is a specification of a blast-furnace creosote which has been used with satisfactory results on several plants.

Distillate below 200° C., none.
,, 200° to 230° C., 15 per cent.
,, 230° to 280° C., 50 per cent.
,, 280° to 300° C., 20 per cent.

It is a common thing to find on benzol plants that there is no system in the way in which fresh oil is put into circulation and spent oil taken out. The change should be made regularly, and the same amount of oil always kept in circulation. Oil should be changed when it is found that the distillate below 300° C. falls short of 60 per cent. If this is not done, it simply means that the scrubbing is inefficient, and that all the benzol is not being recovered. The new oil should be allowed to enter at the last scrubber, so as to bring it into contact with gas which is partly debenzolized. This will ensure that practically the whole of the benzol is removed. The scrubbing oil must not be overloaded with benzol, or else its scrubbing efficiency is diminished. Usually a content of 3 to 4 per cent. of benzol in the oil is the maximum allowable for efficient working. When the oil reaches this strength, it should be run off for distillation.

The debenzolized oil leaving the still should be tested frequently by distillation; and it should never contain more than about 0·5 per cent. of benzol, and usually less than this. If the amount is allowed to be more than this, it proves that the still is not working properly—probably the temperature is not high enough. Also a lot of unnecessary work is done in pumping partially debenzolized oil instead of clean oil; and thus again the scrubbing efficiency is diminished. Frequent tests should, therefore, be made on fresh oil, rich oil, and weak oil, as on these largely depends the satisfactory extraction of the benzol from the gas.

The actual working of the still requires attention, in order to bring about complete separation of the benzol from the washing oil. Crude benzol always contains a fair proportion of constituents boiling at a temperature above 120° C.; and although these exert a moderate vapour pressure at that temperature, and partially separate from the oil, yet full separation is not obtained unless at some point or other, either in the superheater or in the still itself, the temperature reaches (say) 135° C. This means, therefore, that a watch must be kept on the steam pressure to see that it is maintained at a sufficient degree to give the required temperature. It is no use at all to try and work a benzol plant satisfactorily if the steam pressure on the plant is only about 40 lbs.—a state of affairs which the writer has met with on more than one occasion.

It is often thought that the scrubbing portion of a benzol plant will look after itself. So it will if the oil is all right before entering this portion of the plant. The chemical requirements of the oil have been pointed out above; but the physical properties must also receive attention. It is scarcely necessary to point out that great care must be taken to prevent the admixture of much water with the oil. The most important precaution in this section is to see that the weak oil returning from the still to the scrubbers is thoroughly cooled. The temperature of the oil used in the scrubbers should never rise above 25° C., and it is better to keep it nearer 20° C. Benzol has quite an appreciable vapour pressure at 25° C.; and at this temperature very thorough scrubbing is necessary to bring about complete extraction of the benzol. It is advisable, too, in hot weather, to distil the scrubbing oil when it contains about 3 per cent. of benzol, instead of about 5 per cent. The benzol itself should be tested frequently, and any marked change from the normal quality should be inquired into immediately, and adequate reason for the change should be found. The same applies, of course, to any change in quantity. Usually some very good reason will be found for any change; and it cannot fail to be noticed, after a short time, that scientific control pays in every way. It prevents the purchase of unsuitable materials, reduces the necessary work to a minimum, and ensures the production of the maximum amount of the highest grade of spirit with a minimum of worry and expense.

The City of Victoria, British Columbia, has recently obtained a much-needed increase in its water supply—from Sooke Lake, through a pipe-line 27 miles in length. From a reservoir formed by raising the level of the lake 12 feet, water is delivered to a concrete pipe laid on a gradient averaging 1 in 1000, which in turn discharges into the city reservoir. The supply thus provided amounts to some 21 million gallons per day. The concrete pipeline is 27 miles long; the pipe has a diameter of 42 inches; and there are places where the water in the pipe has behind it very considerable heads—running as high as 90 feet, or a pressure of 39 lbs. per square inch.

CARBIDE MANUFACTURE.*

We cannot call to mind that there has been published, prior to the appearance of Mr. Bingham's work which is now before us, any book devoted solely to carbide manufacture. Certain books have dealt with the subject by way of introduction to a fuller treatment of the production and use of acetylene; but as a fact few users of acetylene have any strong interest in the technical aspects of carbide manufacture, and it is better from every point of view that authors and readers should not devote attention to carbide manufacture and the production and use of acetylene in one and the same volume. It is only when the quality of the carbide is concerned that the two subjects in any way overlap.

If only on this account we welcome the appearance of Mr. Bingham's little volume, which gives much valuable information collected by one who has had a really wide practical acquaintance with the manufacture of calcium carbide. The subject perhaps interests the majority of readers of the "JOURNAL" only in two respects—viz., that coke is sometimes used as the raw carbonaceous material for carbide manufacture, and that acetylene is now employed even on gas-works for certain welding and cutting operations for which it is pre-eminently fitted. The coke used is, however, generally obtained from coke-ovens, though there is no reason why gas coke from coal containing a low proportion of ash which is not highly ferruginous should not be utilized. Coke has the advantage over anthracite that with it the carbide furnaces start and work more easily, while the consumption of electrode is considerably lower.

Carbide has long ceased to be regarded by gas engineers as the basis of a competitive illuminating and heating agent; for it is very rarely that there is any real question of competition between acetylene and coal gas. On the other hand, acetylene installations in outlying districts help to create the gas habit, and so pave the way for an extension of town gas supplies. Acetylene at its best is almost an ideal lighting agent in all respects, and from the standpoint of eye-comfort and hygiene so far surpasses electric lighting that it is a wonder that for country house installations the latter continues to find patrons. Carbide which decomposes very rapidly does not yield (in most forms of generating apparatus) acetylene of a reasonably high degree of purity; and Mr. Bingham thinks that the more extended employment of "treated" carbide, in which the generation of gas is retarded, will ensure acetylene being always seen at its best, with consequent cessation of burner troubles and poor light. There is a great deal to be said in favour of his contention.

THE INTERNAL COMBUSTION ENGINE.

A Review by Mr. Dugald Clerk, D.Sc.

In a lengthy and very complete review of the origin and development of all forms of internal combustion engines before the Royal Society of Arts on Wednesday last, Mr. DUGALD CLERK, D.Sc., F.R.S., said that although the credit of steam inventions was given to British engineers, many of the general public and some of our engineers seemed unaware of the leading part played by England in the great field of invention covered by internal combustion engines. It was imagined that in this subject we were wholely indebted to Germany, and that the work of invention here was small compared to that of the Continent. This impression had arisen because of the indefatigable propaganda of scientific engineering in Germany, and the distinct bias to German methods shown by some of our prominent men. In the development of internal combustion engines, we had borne our full share of pioneer work. It is true that effort, both in the past and the present, was more uniformly distributed among the nations in this field than in steam; but we held our own in the competition towards more perfect thermo-dynamic methods and machines.

Mr. Clerk then sketched the history of the gas-engine, and pointed out that whereas in 1876 the total power generated by gas-engines in the United Kingdom did not exceed 2000 B.H.P., in 1907 the total for factories alone amounted to 680,177 H.P.; while the total for all forms of internal combustion engine for all purposes exceeded 1,500,000 H.P. In Germany, a total of 531,000 H.P. of internal combustion engines existed in 1907, while the census of production of the United States for 1909 showed 1,299,021 H.P. of gas and gasolene engines for stationary work. England, Germany, the United States, and France showed a total of at least 6 million horse power of gas, oil, and petrol engines in 1909. In that year, America led the world in the power of such engines at work, Great Britain came second, and France and Germany were nearly equal with the third place. Although great expansion had since taken place in all these countries, Germany still retained the same relative position—America and England leading.

Many of the larger gas-engines in Germany and America operate upon the Clerk modification of the two-stroke compression engine, as adopted by Messrs. Körting, of Hanover, and their licensees. In Germany in 1907, 260,000 B.H.P. was produced in that country by four-stroke engines, and 91,000 B.H.P. by two-stroke engines. The early development of the four-stroke engine was seriously hampered by an erroneous theory of the action of the explosion under compression, and supported in Germany by a physicist even so learned as Dr. Slaby. This erroneous theory also received support from several English scientific men of eminence. The greater part of the credit of working out the true theory of operation of compression gas-engines fell to Great Britain—a paper by Mr. Clerk himself, before the Institution of Civil Engineers, in 1882, proving definitely and numerically the relative improvement in thermal efficiency to be expected by using compression previous to ignition. In more recent years, of course, an important portion of the work of investigation of the conditions of gaseous explosions was due to the British Association Gaseous Explosions Committee.

An impression has grown in this country that Germany was more advanced in the application of internal combustion power than we were. This was due to the fact that the Germans had devoted much more attention to the large-cylinder gas-engine and oil-engine than the British. English engineers had never been satisfied with the existing line of development of these large-cylinder engines. From the scientific point of view, they consider that the building of large gas-engines practically without modification of either thermodynamic or operative cycle was a costly mistake leading to development in a wrong direction. Accordingly, in England more attention had been given to the multi-cylinder gas-engine than in Germany; the idea being to keep the dimensions as small as possible. By so doing, engines were produced of a greater power for a given weight of metal. British engineers and scientific men were still convinced that other methods must be found of increasing power in internal combustion engines than mere increase of dimensions of cylinders and massive construction of engine parts as practised in Germany. Undoubtedly a solution will be found which combined high powers with small weights. A very large industry had been created in small-cylinder engines; but the power unit attained as yet was not sufficiently great to compete with the larger steam-engines, especially in the form of steam-turbines.

Discussion.

Sir CHARLES PARSONS, who was in the chair, said the question of the large cylinder *versus* the small cylinder was a subject of very great discussion in this country about two years before the war. The Germans contended that the large-cylinder engine was all right; and some people said that the British engineers could not build a successful engine of this type. The experiments of our scientists, however, showed that in the large cylinder the heat transmitted to the walls was very much more intense than in the small cylinder. Other things being equal, the heat varied as the square root of the dimensions of the cylinder. Therefore, beyond a certain size of cylinder—viz., 200 H.P. or 300 H.P.—the heat became so intense that no metal would stand it. The rise in temperature was such that the surface of the metal was compressed beyond its elastic limit, and on cooling it was subjected to a tension beyond the elastic limit. Eventually cracks developed, which finally resulted in a crack right through and a burst cylinder. Steel was worse than cast iron in this respect.

Professor E. G. COKER said that it was Mr. Dugald Clerk himself who had been the inspiring influence in the work of the British Association Gaseous Explosions Committee. He had gathered together a number of people interested in the gas-engine, both engineers and chemists, and kept them all very busy for a good many years working on different problems. The war had put an end to the Committee's activities for the present; but it was hoped to resume work later on. Could Mr. Clerk say what progress had been made with the gas-turbine? At the Leicester meeting of the British Association, mention was made of a 1000 H.P. gas-turbine which was going to be a revolution on anything that had been done before. He had not heard very much about it since.

Mr. DUGALD CLERK said that the experiments with the gas-turbine mentioned by Professor Coker were a failure. At the 1912 meeting of the British Association, Herr Holsworth, who had designed the machine, sent him some particulars which showed a very much lower efficiency and very much lower power than had been anticipated originally. Some work had been done since then, however; but he had not heard with what success. It was not the slightest good designing a gas-turbine unless it had some of the advantages of the internal combustion engine. The great advantage of the internal combustion engine was that it gave very high thermal efficiency. The steam-turbine had made marvellous progress, and gave very high efficiencies indeed; but they were not efficiencies from the thermal point of view, and were not equal to the thermal efficiency of the internal combustion engine. Even if a gas-turbine was made with an efficiency as high as that of the steam-turbine, it would be no use putting such a machine on the market, because the steam-turbine had an enormous advantage in that the temperature conditions were very much easier, whereas the temperature conditions in the gas-turbine were troublesome. So far as he knew, the gas-turbine had not yet succeeded, although it might do so in the end.

* "The Manufacture of Carbide of Calcium." By Charles Bingham, C.E., Managing-Director of, and Consulting Engineer to, the Calcium Carbide Factories at Notodden, Thornhill, Cordoba, Mexico City, &c. With illustrations. London: Raggett and Co.; 1916.

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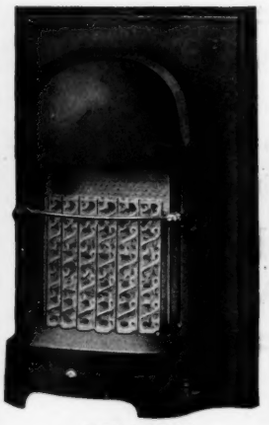

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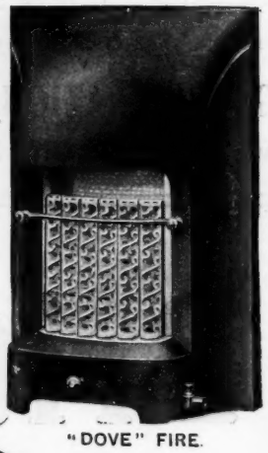

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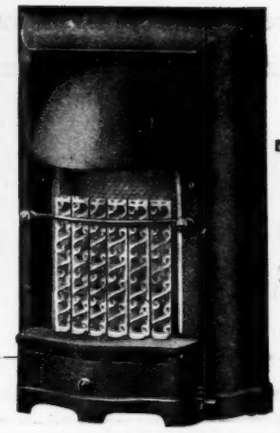

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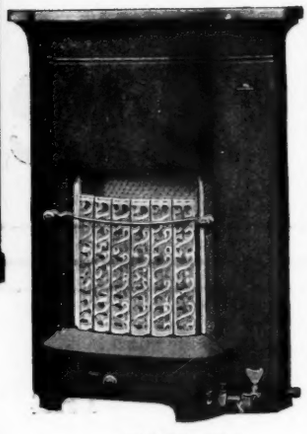

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BENZOL RECOVERY IN GAS-WORKS.

By D. Bagley.

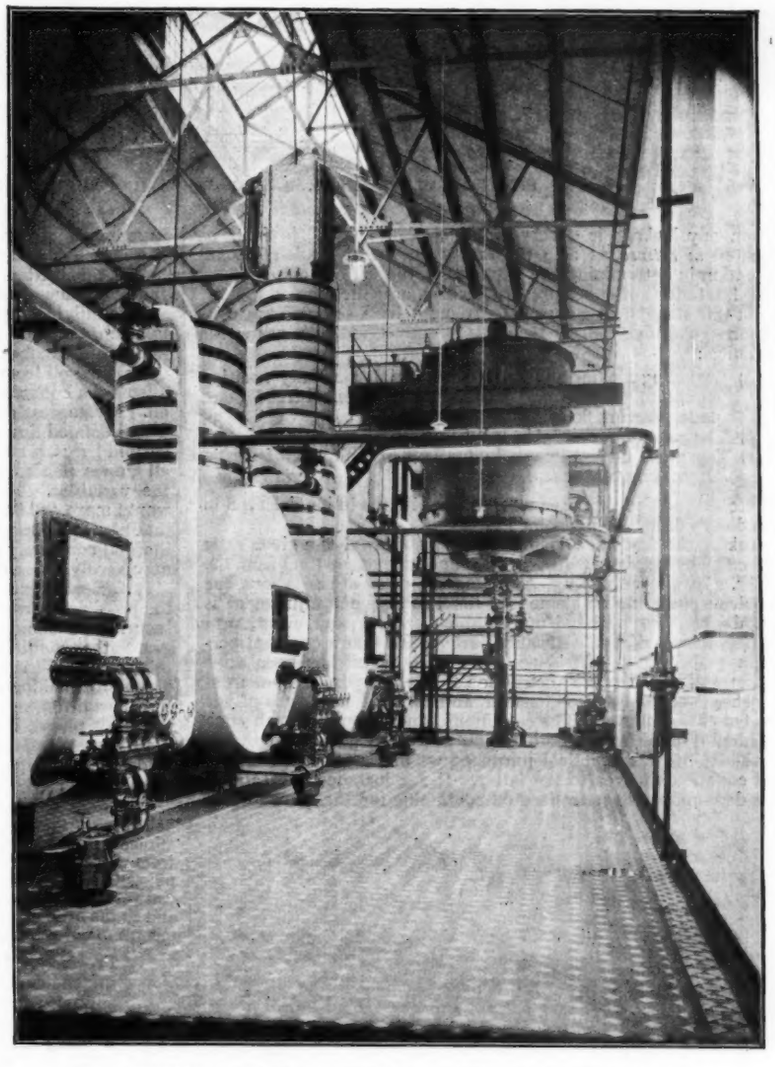
The gas industry, confronted with a peremptory demand for those members of the benzene series that national necessity urgently called for, immediately rose to the occasion, and adopted such permissible processes as the limiting and difficult conditions allowed.

After submitting some gas-works' products to the most searching investigations and advancing them, I am able to vouch for the measure of success achieved. What was, however, thought to be a temporary expedient will become *de facto* settled practice in connection with the manufacture of illuminating gas; and, the realization of this phase tends towards improvement, having in mind the conditions which will obtain in the future. These obviously differ from those met with in coke-oven practice; but I propose to outline the latter process, and to briefly examine some of the probable governing conditions in relation to the gas industry which have been from time to time conveyed to me. In reality, critical treatment and the application of known formulæ are, perhaps, more desirable in a technical article if it is to be productive of constructive argument; but it is impossible to compress this into a descriptive essay without imperilling its usefulness as applicable data.

Fig. 1 (p. 492) is a type of benzol recovery plant operated in conjunction with bye-product ovens. The system is a continuous one, simply controlled, and utilizing to the full the heat of the hydrocarbon vapours. The ammonia freed and cooled gases enter the tower scrubber A, and pass in series through the scrubbers B C, in counter-current to the absorbent oil—thus gradually enriched by the hydrocarbons taken up. The vertical plunger pump D draws debenzolized oil from the tank E (by suction-tube), and delivers it to the feed-control situated on the scrubber C. The oil is distributed within the scrubber by a slotted corrugated diaphragm. The partly enriched oil flows through the tube F to the tank G, and is drawn by the pump H (by suction-pipe) and forced to the scrubber B. It is returned by the tube I to the tank J, and forced by means of the pump K to the scrubber A; the fully-enriched oil being finally returned to the tank L.

It will be observed that the process is virtually a counter-current one familiar to the industry. The degree of enrichment of the absorbent oil forms a distinctive curve; and to those engineers operating two or more towers in series, I recommend a careful analysis of the enriched oil taken from the several stages—obviously not confining this determination purely to benzol or its homologues.

The enriched oil is drawn from the tank L, and forced continuously by the pump M to the central and upper sections of the condensers N O—receiving a preliminary heating from, and acting as a cooling medium for, the vapours from the still D. Throughout, it is advisable to observe the possible limit to efficiency in this direction. A partial separation of higher boiling products (such as wash-oil and naphthalene) is permissible by the employment of the two sections N O. The preheated oil flows to Q, the oil-heater proper. For convenience, this heater is made up of two distinct sections, each containing a steam-heating coil.



INTERIOR VIEW OF A "STILL" BENZOL PLANT HOUSE.

It occasionally happens that the small percentage of water present with the wash-oil contains ammonia which is liberated on heating. The coil is thereby attacked, and in course of time perforated. To avoid stoppage, another section may be immediately put into operation, and the damaged coil repaired and replaced without interfering in any way with the continuity of the process. The benzolized oil is heated to the desired degree, and flows to the still R—the lower part containing a direct steam-spray.

The benzol, &c., vapours are driven off, carrying naphthalene and a certain amount of the wash-oil, and pass, *viâ* the vapour tube, to the upper sections of the condenser N O. Complete condensation is effected in the lower section. Condensed water and benzol are continuously removed by the outlet tubes R S respectively; and the 65 per cent. or other quality crude benzol is passed to the store tank T.

Various devices have been proposed for separating the wash-oil and naphthalene carried over with the benzol, &c., from the column still R. The mixture flowing into the still presents, in reality, one of those complicated phases not often met with in fractional distillation, while the presence of a large volume of steam adds to the complex nature of the problem. A reflux condenser mounted on the still, with arrangements for separately withdrawing the condensate from the upper trays of the column, has been tried with more or less success; but it will be obvious that the only rational method (by no means perfect however), consists in separating during condensation. If the crude benzol is fractionated into its several pure products by stills in proximity to the recovery plant, the presence of wash-oil and naphthalene in the crude is of little account. If, however, as is the case with many small works, the crude is refined at works situated some distance away, then the presence of 20 or 30 per cent. of wash-oil adds to the carriage, and depletes the store of wash-oil.

The hot debenzolized oil from the still R flows through a seal U and outlet tube V to the oil-coolers. These may be of the tubular type, acting on the counter-current principle, using water as the cooling medium. It has been proposed to use cold benzolized oil as the medium replacing water. While this is practicable, a little consideration will show that, to secure the same efficiency as with water, the cooling apparatus would need to be considerably enlarged; and it is questionable if any true economic advantage is thereby secured. Our own tests, in fact, gave a negative result. The cool debenzolized oil is returned to the tank E, and again put into circulation. The plant possesses means for withdrawing from time to time a certain quantity of the used wash-oil, and replacing it by fresh oil.

While this plant may be truly regarded as one of the simplest forms, the construction of its components and the choice of materials therefor must be, and is, based upon knowledge gained from protracted observation—a *sine quâ non* if the first and foremost conditions (those of continuous and uninterrupted service, with the maximum yield under variable flow of gases) are to be achieved. For instance, the scrubbers—leaving aside their dimensions and the area of the exposed surfaces within, calculable only from known formulæ—must be gas and oil tight; and a metal-to-metal joint only is permissible. This is obvious from the corrosive nature of the absorbent oil, and the difficulty of caulking

FIG. 1.—BAGLEY, MILLS, AND CO.'S "STILL" BENZOL RECOVERY PLANT.

when any leakage is observed. Each detail could, in fact, be treated *in extenso*, as also the errors due to any rule-of-thumb equation in determining the capacity of the various components. But limitations of space prevent such an amplification.

At this stage it is convenient to summarize some of the conditions governing benzol recovery in connection with gas-works practice:

(*a*) Assuming a calorific standard to remain practically a settled condition, the thermal constancy of the benzol-freed gases under varying flow.
(*b*) The naphthalene (C_nH_{2n-6}) ratio.
(*c*) The more or less heavy fluctuations in the make of gas in alternating seasons.

There are, of course, other essential conditions to be observed in the design of benzol plant for gas-works.

Taking the first (*a*), this implies the withdrawal of a given ratio of benzol hydrocarbons (neglecting naphthalene, *pro tem.*) from the gases. In all probability, assuming the ratio to rise above the required point for an element of time, subsequent adjustment is permissible, but perhaps undesirable; and, in any event, promoting complications. But if we are agreed that a constant percentage absorption with a constant grade of oil has been or is predetermined, then the abstraction of benzol hydrocarbons from the gases should be also constant, and thermal constancy of the treated gases follows. The conditions which would disturb such an ideality are present both in the untreated gases and in the wash-oil; but for practical purposes, we may neglect the former and confine ourselves to the latter. If, for instance, the ratio is founded upon a debenzolized oil containing for the purposes of argument 0·75 per cent. of benzol, &c., and 10 per cent. of naphthalene, should these quantities be raised, the degree of absorption under the settled conditions will fall proportionately, and the thermal value of the treated gases rises.

A faultily-designed still is one cause of such an eventuation, and is also the means for bringing the benzolized oil to the desired temperature before entering the still. The "frothing-over" of the benzolized oil from the heater is a case in point, which temporarily affects the constancy of the debenzolized or partially debenzolized oil. My impression is that it is at all times possible to work within a well-defined limit, as representing the calorific standard of the treated gases, if the thermal constancy is taken into account under all known phases of operation, and due provision made to meet the variables. There are naturally many other factors which would more or less affect the desired result; and it may be argued that plant as operated in conjunction with coke-ovens in which the thermal constancy of the treated gases is a matter of no moment, may hardly be used as an illustration.

But, consider the effect of any variation as immediately affecting the possible yield of benzol; and it will be at once evident that in securing constancy, represented by the benzol remaining in the gases, the conditions are not too dissimilar. Finally, it occurs to me that a less valuable commodity might conceivably be employed for making-up any deficiency in the calorific value of a gas, thus permitting of the maximum abstraction continuously. But, as to this phase, I am not sufficiently informed.

In the second case (*b*), Mr. G. T. Purves, in his Presidential Address before the Scottish Junior Gas Association [*ante*, p. 296], rightly says:

"In order to produce the higher grades of light oil, naphthalene, and some of the higher benzene homologues [N.B., As also some constituents of the wash-oil] which are being carried away by the vapour from the wash-oil still are thrown back into the wash-oil by partial dephlegmation. In this way the naphthalene absorption power of the wash-oil is reduced, while the benzene absorption power is unimpaired, and so the ratio of naphthalene to condensible liquid hydrocarbons in the gas may be increased by oil-washing."

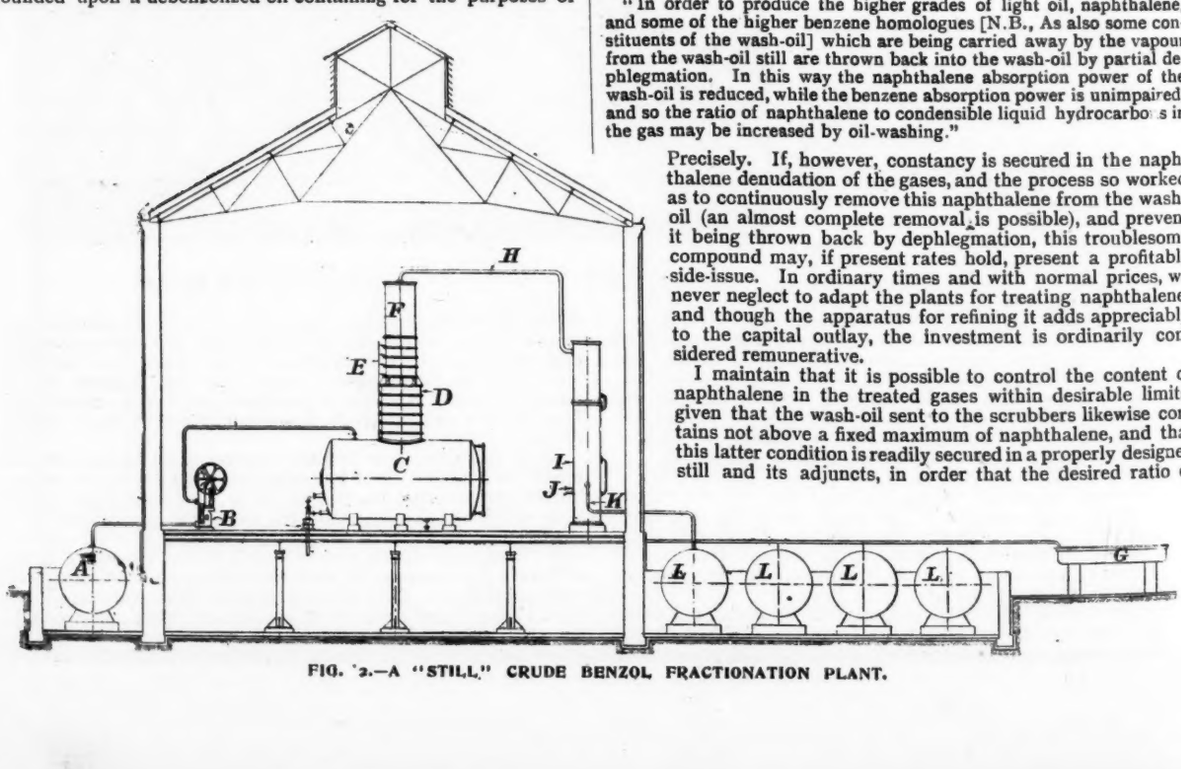


FIG. 2.—A "STILL" CRUDE BENZOL FRACTIONATION PLANT.

Precisely. If, however, constancy is secured in the naphthalene denudation of the gases, and the process so worked as to continuously remove this naphthalene from the wash-oil (an almost complete removal is possible), and prevent it being thrown back by dephlegmation, this troublesome compound may, if present rates hold, present a profitable side-issue. In ordinary times and with normal prices, we never neglect to adapt the plants for treating naphthalene, and though the apparatus for refining it adds appreciably to the capital outlay, the investment is ordinarily considered remunerative.

I maintain that it is possible to control the content of naphthalene in the treated gases within desirable limits, given that the wash-oil sent to the scrubbers likewise contains not above a fixed maximum of naphthalene, and that this latter condition is readily secured in a properly designed still and its adjuncts, in order that the desired ratio of

naphthalene to benzol in the treated gases may be maintained within practicable limits.

In dealing with (*c*), here we have a condition fortunately not frequently met with in coke-oven practice; for full capacity is the rule. At the same time, the phase would hardly affect the ovens, where the maximum yield of benzol is the aim and end, and thermal considerations as affecting the gases find no place. It might be assumed that a curve showing the gas make could be utilized in hypothetically increasing or decreasing the oiled contact surfaces. It will be obvious, by considering an absorption curve of the wash-oil, that such a proposal is valueless, and that other means have to be sought to deal with any material variation in the flow of gases. I again assume it is to be a condition precedent that a quota of benzol shall remain in the gases to (what I shall term) balance a given content of naphthalene. Thus the only rational means is to proportionately decrease the absorptive power of the wash-oil. This, again, in a properly designed plant is both possible and practicable, though it follows that the efficiency as regards yield may vary slightly with what, in reality, amounts to a radical alteration. Naturally, if the make of gas be reduced to the extent of 30 or 40 per cent. on a plant operating three or more scrubbers, it would be politic to cut out one of these units.

In gas-works as opposed to coke-ovens practice, there is a fourth variable in the shape of coal, which involves all the provisions adopted to meet (*a*), (*b*), and (*c*). There are, as I have previously stated, still other variables; but, if these be known, practice admits of adequate means of meeting them, and still securing the best results from the plant.

Fig. 2 shows one method of fractionating the crude benzol, previous to individual purification and rectification of the various products. The crude is drawn from the tank A, by the pump B, and the still C is thereby charged. The still is fitted with two independent and indirect coils, and one direct spray with special control valves—the indirect coils being coupled-up to a separator. The condensed water from all the coils is returned to the boiler-feed. The still is fitted with two columns D E, and a tubular dephlegmator F. The fractions made consist of "first run" crude 90 per cent. benzol, 90 per cent. toluol, a mixture of 90 per cent. toluol and xylol, xylol, a mixture of xylol and solvent naphtha, and crude solvent naphtha. The residue, consisting of wash-oil and a large proportion of naphthalene, is run into an open crystallizing pan G, and on cooling the naphthalene separates out, and the wash-oil is returned into circulation. The vapours are conducted by the tube H to the condenser I—condensed water and benzol being automatically separated and run away respectively by J K; the benzol fractions passing to the store-tanks L.

Fig. 3 depicts the process of washing and refining the individual products. The agitator A is charged, and the product intimately mixed with sulphuric acid drawn from B, and measured in C. The used acid is then withdrawn, and the product washed with water. This is followed by complete neutralization of any remaining acid with a solution of caustic soda, prepared in D, and measured in E. The purified product is stored in F, and finally passed into the still G. The still is fitted with two independent indirect heating coils and one spray; and for the higher boiling homologues a vacuum may be employed. Two columns H I are fitted, and a special dephlegmator J. The vapours pass to the condenser K and the condensate is received in the container L, whence it flows to a divided receiver M, provided for the purpose of mixing various quantities of distillate to secure a constant product fulfilling the conditions of the trade specification. N are the store tanks.

This rectifying plant differs slightly from the standard type, and is arranged to permit the direct loading of tank cars. In fact, it typifies a plant erected in which after charging the crude stills (the condensers being arranged at a convenient height) the product finally gravitates into the store tanks without the aid of pumps. Probably the least complicated method of solving all the problems here enumerated would be to more or less denude the gases of $C_n H_{2n-6}$, and utilize either the less valuable higher boiling homologues of this series—or possibly paraffin, in the interests of economy—both to make up any thermal deficiency, and balance the naphthalene. There may, of course, be objections to such a proposal; but these are not presently discernible.

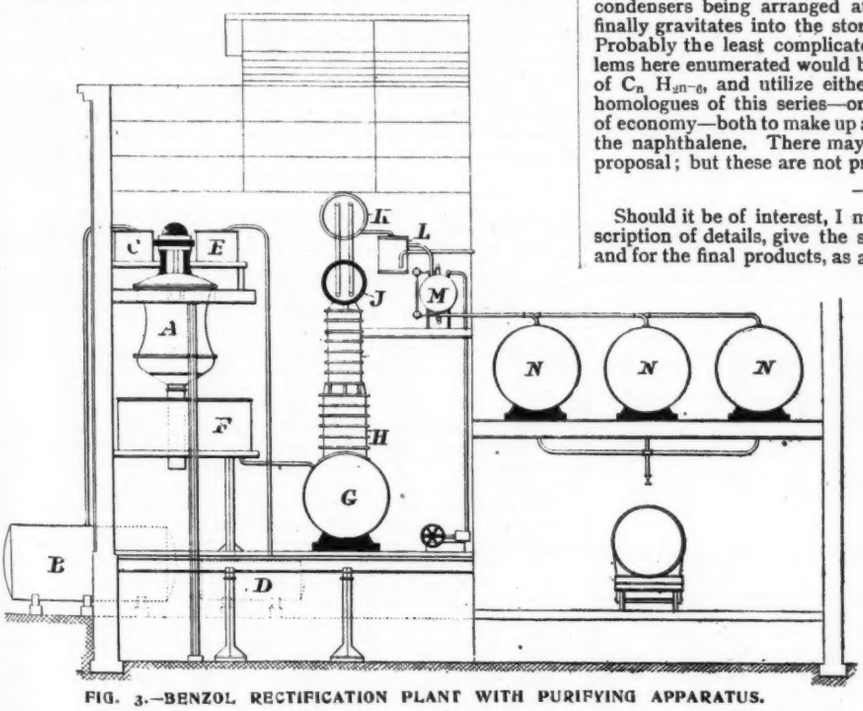


FIG. 3.—BENZOL RECTIFICATION PLANT WITH PURIFYING APPARATUS.

Should it be of interest, I may in another article expand a description of details, give the specifications we adopt for wash-oil and for the final products, as adopted by the trade, together with amplified descriptive text relating to the operation.

Nationally, the urgent need for benzol, toluol, &c., remains. My desire is, so far as my capabilities permit, to assist in promoting the output. The gas industry has so far played a conspicuously patriotic *rôle*, which might be imitated in many quarters. If I can, therefore, aid the cause by showing practical examples—remembering that I am not "related" to the gas industry and therefore not possessing the technical knowledge of the gas engineer—and if by relegating all thought of personal profit to some period following the conclusion of the peace we are striving for, there are those who can make use of our services, the objective of this article will have been achieved.

Monazite Industry in the United States.

A technical paper by Mr. K. L. Kithil, issued by the United States Bureau of Mines [the first portion of which is reproduced in the current issue of the "Chemical News"], deals fully with the monazite industry of America. It is pointed out that there are deposits of monazite in several of the States; and with the knowledge that a valuable product—mesothorium—can be made as a bye-product from the residues of thorium nitrate manufacture, the industry may be developed in the country, and should pay well. Mesothorium is used successfully in therapy, in the same way as radium. It is therefore with the object of aiding the more efficient utilization of radio-active minerals that the Bureau of Mines have prepared this description of the occurrences of monazite in the United States, the uses to which its products can be put, and the methods of mining and treatment. In the United States, occurrences of monazite are known in many other States than the Carolinas; but it is probable, Mr. Kithil states, that the deposits in Idaho and the Carolinas alone are of importance commercially. The deposits in the Carolinas cover an area of several hundred square miles east of the Blue Ridge Mountains. The monazite deposits near Centerville and Idaho City, Idaho, seem of special importance. There is no doubt that considerable monazite will be found in many places in the State; and all the gravels of the deposits contain a considerable amount of gold, which makes possible the working of such deposits for both gold and monazite. The gravel beds are considerably thicker than those in the Carolinas; and much monazite should be obtained from the tailings from the old gold washings. Monazite has been found in the State of Colorado some 20 miles south of Denver in the Newlands Gulch district, where the monazite occurs in some of the gravels, which carry also considerable gold. Monazite is also reported in the Platte Canyon. The world's consumption of monazite is now about 3000 tons per annum; while the annual world consumption of incandescent gas-mantles is estimated at 330 millions. The United States alone, in spite of the development and use of electric metal-filament lamps, has consumed in the past few years some 80 million incandescent gas-mantles, as against 40 millions total before the year 1904.

By permission of the Birmingham Corporation Gas Committee, members of the Midland Junior Gas Association will, next Saturday, inspect the benzol recovery plant and other features of interest at the Nechells works. The visitors will be received by the Engineer (Mr. E. B. Tomlinson); and a description of the working of the benzol plant will be given by the Chief Chemist (Mr. E. W. Smith).

POWER PRODUCTION.

THE "MONEY SIDE" OF TOWN'S GAS AND PRODUCER GAS INSTALLATIONS.

By "M.J.Inst.E."

(*Continued from p.* 441.)

Water Charges.

Taking the case of the water consumption of a complete producer-gas plant, the water used may be split-up into two amounts —namely, that used in the producer itself, which would amount to about 1½ gallons per brake-horse-power hour, and that used for cooling the cylinders of the engine.

At full load, and assuming the water is run straight through the engine-jacket, it is customary to allow about 6 to 8 gallons per brake-horse-power hour for this purpose; but if, as is more usually the case, circulating tanks are employed, this quantity would be reduced by about 50 to 60 per cent. In connection with the supply of water for the cooling of the engine cylinders, this need not always constitute a debit charge in relation to the operating costs of the installation, as in many industries employing gas-engines for power purposes there exists a demand for a supply of warm water; and there is not the slightest reason why this supply should not be drawn from the circulating water-tanks at or near the point at which the flow from the engine enters.

The generation of heat is inseparable from the employment of internal combustion engines; but if intelligently handled and applied, the heat so generated may be looked upon in the light of a valuable asset. In a recent case in which the author acted in an advisory capacity, the feed for a small Babcock and Willcox boiler was drawn from the circulating tanks of an old 15 B.H.P. gas-engine, and resulted in a saving of 20 per cent. on the fuel bill. If it be desired to obtain the highest degree of thermal efficiency, the Bonecourt waste-heat boiler provides a ready means of utilizing the heat contained in the exhaust gases of the engine. But these are advantages which are common to the employment of all gas-engines, whether running on a town or on a producer supply, and lie outside the sphere of this article.

The actual amount of water required for the efficient cooling of the cylinders of large internal combustion engines varies very widely with different installations, according to the system employed for the circulation and cooling of the water, the capacity, number, design, and situation of the cooling tanks or vessels employed. In very few installations are these arrangements so carried out as to obtain a maximum degree of efficiency; and it is generally found necessary to supplement the work of the circulating tanks by keeping a constant flow of cold water into the system.

For the purposes of the comparison of running costs, we will assume that in the respective cases under consideration no use can be found for the heated circulating water, and that the general arrangement of the engine and its tanks is such as to necessitate cold water being kept running into the cooling system at the rate of 3 gallons per brake-horse-power hour—thus making a total water consumption, in the case of the producer plant, of $3 + 1\frac{1}{2}$ gallons of water per brake-horse-power hour.

Lubrication Charges.

These charges, practically speaking, are common to both types of installations; any difference which may be due to the slightly larger engine necessary, power for power, in the case of the producer gas plant, being too trifling to warrant its being taken into account. The consumption of lubricating oil is sometimes expressed in terms of pints per brake-horse-power hour; but it must be distinctly understood that figures so expressed only hold good for the load factor in conjunction with which they are, or should be, mentioned, and cannot be safely applied over all ranges of loading.

A more convenient form in which to express this figure, having regard to any particular engine, is in terms of the number of hours which such an engine will run on a gallon of lubricating oil. Taking as an example the 80 B.H.P. engine on which we are basing our estimates of running costs, the following table shows the number of hours which we might reasonably expect this engine to run with one gallon of oil of good quality, having due regard to the conditions of loading. These figures, it may be explained, apply to a modern type of engine fitted with automatic ring lubrication to the main crank shaft bearings.

Table No. I.—*Showing How Long One Gallon of Good Quality Lubricating Oil may be Expected to Last in Running an* 80 B.H.P. *Gas-Engine.*

Plant Load Factor.	Output.	One Gallon will Last.		Consumption per B.H.P. Hour.	Cost at 2s. per Gallon per B.H.P. Hour.
		Hours.	B.H.P. Hours.		
Per Cent.	B.H.P.			Pint.	d.
100	80	9	720	0·011	0·03
75	60	10	600	0·013	0·04
50	40	12	480	0·016	0·05
25	20	15	300	0·026	0·08

Attendance Charges.

In dealing with the above costs, we have not, unfortunately, the same hard-and-fast data on which to base our estimates as is at our service in respect to the other items which go to make up the total running costs of a power plant. The question is one on which opinions differ widely; it is one on which a great deal of money can be both saved and wasted; and it is one with which the well-being of the plant is closely associated.

In the case of both the town's gas-engine and the electric motor, either of these machines will run for hours without attention. On the other hand, there is always the possibility of something going wrong which an occasional inspection might have detected in an incipient stage. There are many little points about both a town's gas and an electric installation which quite justify a man spending about ten minutes every hour giving a glance around and a wipe down; but except in the case of large plants (which are not being dealt with), it is a very debatable point whether it is necessary for any man to devote his whole time to attendance upon one single power producing unit. Such a practice constitutes, in the writer's opinion, the height of imbecility, and must, in most cases, ultimately result in adding to the already great number of "workshys."

We may draw a line of difference between the cases of (say) a gas-engine driving straight on to a line of shafting and the case of the same engine driving an electrical generator. In the latter case, attention has to be given not only to the engine but to the dynamo and switchgear; and a more liberal allowance must be made for attendance, according to the character of the load and the amount of attention required at the switchboard to replace blown fuses, fallen circuit-breakers, &c.

The question again takes on another aspect when there is a duplicate set installed, in which case, especially if the hours of running are fairly long, there may be quite sufficient to warrant the employment of a whole-time attendant in view of the small adjustments and repairs which will no doubt be necessary, and which he should be capable of executing in the intervals when his attention is not engaged in connection with the running unit.

In considering the case of a producer gas plant, allowance must be made for the attention which will have to be given to the scrubber, producer, &c., in addition to that which the dictates of prudence require should be given to the engine and its immediate driven gear. In the estimates which have hitherto been given, no allowance has been made in respect of duplicate plant; and in deciding a basis on which to put the attendance charges, it will be taken for granted that the plant consist of one single power producing unit. In the case of the engine running on town's gas, it will be assumed that the man responsible for the satisfactory running of the engine gives ten minutes every hour to the inspection of the machine; while in the case of the producer gas plant, it will be assumed that the accessories for the manufacture of the gas take up another ten minutes per hour of the attendant's time—making a total of twenty minutes in all in the latter connection.

Maintenance.

It is by no means an easy matter to fairly allocate the charge with which under this heading a plant must be debited, as so much depends upon the human element and the conditions under which the plant is run. During the first year (say) of the operation of a new plant, the maintenance charges incurred should be practically *nil;* while after the installation has been running (say) seven or eight years, a fairly large overhaul job will have to be faced, and certain portions of the engine in all probability renewed. Also, during these first seven or eight years, the annual charge for maintenance will have gradually increased. It is hence obvious that any estimated charge under this heading must, if it is to be of any value, be an average one covering a fairly long period.

From particulars of the running costs of plants at the writer's disposal, and on the basis of 3000 working hours per annum, it would appear that the maintenance charges in respect to the producer—in the case of a suction-gas plant—taken over a long period may be fairly expressed as about 5 per cent. on the capital cost of the apparatus, assuming a high plant load factor. The charges in respect to the engine itself may be taken as the same in the case of both the producer and the town's gas plant, and will vary from 2 to 3 per cent. on the capital cost of the machine, according to the load factor.

For the purposes of the detailed comparison of running costs which it is proposed to include in this article, the maintenance charges will be taken as being from 2½ to 3½ per cent. in the case of the producer gas plant (covering both producer and engine), and as 2 to 2¾ per cent. in the case of the town's gas installation; the variation in each case being proportional to the plant load factor.

Comparative Tables of Running Costs.

In order to show the actual costs of running a producer gas plant as compared with a plant of similar capacity running on town's gas, four tables of costs per brake-horse-power have been prepared. Each table shows the alternative costs of working (*a*) a suction gas plant, and (*b*) a town's gas plant under similar conditions of loading—it being assumed in each of the cases tabulated that the annual hours of working amount to 3000; the varying element in the case being the plant load factor which varies from 25 per cent. (quarter load) to 100 per cent. (full load). The tables show in detail the respective costs per brake-horse-

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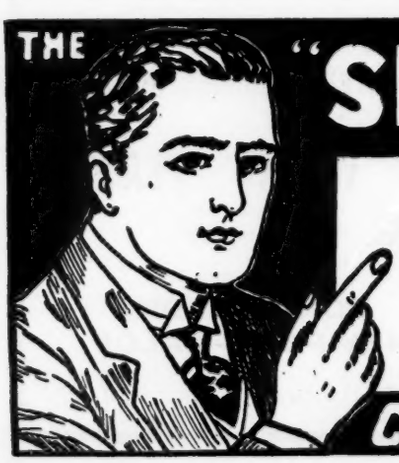

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power of working at quarter load (No. 2), half load (No. 3), three-quarters load (No. 4), and full load (No. 5); while to the right of the costs columns in each table a small percentage column shows the relationship between each separate item and the total running costs.

The following shows the basis upon which these tables have been prepared:

Maximum continuous capacity of plant, brake-horse-power. 80

Plant load factor $= \frac{\text{average load} \times 100}{\text{full load}} =$

Working hours per annum	3000
Price of anthracite, per ton	42s.
Price of town's gas, per 1000 cubic feet	2s.
Price of oil, per gallon	2s.
Price of water, per 1000 gallons	6d.
Labour, per hour	7d.

Without preparing a multiplicity of such tables, it is impossible to form estimates of running costs which will apply without modification in all quarters of the United Kingdom; and the respective fuel charges selected as a basis of comparison are average rates, which may fairly be considered as pertaining at the present time.

The price of anthracite must necessarily vary considerably with the geographical position of the plant in relation to the coalfields. In many localities this fuel is obtainable at a much lower figure than 42s. per ton; while, conversely, there are gas undertakings retailing gas for power purposes at a much lower figure than 2s. per 1000 cubic feet.

The tables, however, lend themselves very readily to any modification which may be necessary in order to render them applicable in districts where the rates for the respective fuels do not approximately coincide with the prices on which these particular estimates are based.

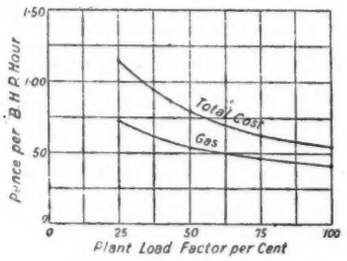


Fig. 5.—Summarizing the Costs of Running an 80 B.H.P. Town's Gas Installation.

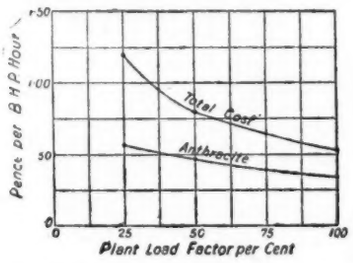


Fig. 6.—Summarizing the Costs of Running an 80 B.H.P. Producer Gas Installation.

The four tables are summarized graphically in figs. 5 and 6, in which the total running costs at the varying load factors of the two sets are shown in full curves, while the charges for fuel alone are shown in dotted curves. It will, of course, be understood that the curves are plotted through four points—namely, those points corresponding to quarter, half, three-quarters, and full load; the cost per brake-horse-power hour at any intermediate load factor as shown in the curves being purely approximate.

RUNNING COSTS IN PENCE PER BRAKE-HORSE-POWER HOUR.

TABLE No. II.—*Showing the Alternative Costs of Working at 25 per Cent. Plant Load Factor.*

Nature of Charge.	Producer Gas Installation.		Town's Gas Installation.	
	d.	Per Cent.	d.	Per Cent.
Capital charges, per cent.	0·280	24·0	0·192	16·8
Fuel	0·564	48·0	0·720	63·1
Lubricating oil	0·080	6·7	0·080	7·1
Water	0·027	2·3	0·018	1·5
Labour	0·116	9·6	0·058	5·2
Maintenance	0·070	5·9	0·038	3·4
Insurance	0·042	3·5	0·032	2·9
Total	1·179	100·0	1·138	100·0

RUNNING COSTS IN PENCE PER BRAKE-HORSE-POWER HOUR.

TABLE No. III.—*Showing the Alternative Costs of Working at 50 per Cent. Plant Load Factor.*

Nature of Charge.	Producer Gas Installation.		Town's Gas Installation.	
	d.	Per Cent.	d.	Per Cent.
Capital charges, per cent.	0·140	17·8	0·096	12·4
Fuel	0·450	57·1	0·540	70·0
Lubricating oil	0·050	6·3	0·050	6·4
Water	0·027	3·4	0·018	2·2
Labour	0·058	7·4	0·029	3·7
Maintenance	0·042	5·3	0·021	2·6
Insurance	0·021	2·7	0·016	2·7
Total	0·788	100·0	0·770	100·0

RUNNING COSTS IN PENCE PER BRAKE-HORSE-POWER HOUR.

TABLE No. IV.—*Showing the Alternative Costs of Working at 75 per Cent. Plant Load Factor.*

Nature of Charge.	Producer Gas Installation.		Town's Gas Installation.	
	d.	Per Cent.	d.	Per Cent.
Capital charges, per cent.	0·094	14·6	0·064	10·4
Fuel	0·394	62·0	0·456	73·1
Lubricating oil	0·040	6·2	0·040	6·5
Water	0·027	4·2	0·018	2·9
Labour	0·039	6·1	0·019	3·0
Maintenance	0·030	4·7	0·016	2·5
Insurance	0·014	2·2	0·010	1·6
Total	0·638	100·0	0·623	100·0

RUNNING COSTS IN PENCE PER BRAKE-HORSE-POWER HOUR.

TABLE No. V.—*Showing the Alternative Costs of Working at 100 per Cent. Plant Load Factor.*

Nature of Charge.	Producer Gas Installation.		Town's Gas Installation.	
	d.	Per Cent.	d.	Per Cent.
Capital charges, per cent.	0·070	13·2	0·048	8·9
Fuel	0·337	64·1	0·408	75·8
Lubricating oil	0·030	5·7	0·030	5·6
Water	0·027	5·1	0·018	3·3
Labour	0·029	5·5	0·014	2·6
Maintenance	0·024	4·5	0·013	2·4
Insurance	0·010	1·9	0·008	1·4
Total	0·527	100·0	0·539	100·0

The following percentage shows the respective influence of the capital and the fuel charges upon the total costs of generation at the varying plant load factors.

Plant Load Factor.	25 Per Cent.		50 Per Cent.		75 Per Cent.		100 Per Cent	
	P	T	P	T	P	T	P	T
Capital charges	24·0	16·8	17·8	12·4	14·6	10·4	13·2	·9
Fuel charges	48·0	63·1	57·1	70·0	62·0	73·1	64·1	7
Other charges	28·0	20·1	25·1	17·6	23·4	16·5	22·7	15·3
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0

(To be continued.)

Newmarket Public Lighting Contract.—Minutes submitted at a meeting of the Newmarket Urban District Council showed that the Council, sitting in private, had, after considering a letter from the Gas Company in reference to the public lighting contract, resolved: "That, having regard to the Company's refusal of the final offer made by the Council, such offer be withdrawn, and the Company informed that matters must now be settled on a strictly legal basis, as the Council are of opinion that they have a complete answer to any claim the Company may make."

Glass Trade of this Country.—The Pro-Chancellor (Mr. A. J. Hobson) was able, at the annual meeting of the Sheffield University, to present a gratifying report of the progress made in recapturing the glass trade from the Germans and Austrians. He remarked that the teaching of the technology of glass had been commenced, and was full of promise for the future. The University were receiving an annual income of £1200 from the Advisory Council of the Privy Council, and had obtained a grant of £1500 from the same source towards capital equipment, £2000 from the Glass Manufacturers' Association, and £3000 from the Ministry of Munitions. A considerable amount of property had been acquired in Sheffield, and works had also been erected elsewhere. The whole movement was the outcome of the fact that in the early days of the war this country was completely cut off from sources of glass supply in Germany and Bohemia.

REGISTER OF PATENTS.

Gas-Lamps.

STANIFORTH, H., of Clapham Common, S.W.

No. 15,801; Nov. 9, 1915.

The type of lamp contemplated by this invention is one generally used for street or outdoor lighting, and comprises a combination of: (*a*) A burner or burner-chamber having an inlet-orifice for the combustible mixture; (*b*) a gas-supply nozzle fed with gas from the main, and projecting from its source of supply towards or beyond the exterior of the lamp-casing from its interior; and (*c*) a removable fitting comprising a bunsen mixer having air-flow and gas-flow regulators upon it, and so constructed in relation to the nozzle and chamber that its inner end can be inserted into the inlet orifice from the outside of the lamp-casing, and simultaneously with this insertion a portion of the mixer makes connection with the gas-supply nozzle.

Preferably in one form of the invention the manually operable portions of the air-flow or gas-flow regulators (or both) extend outside of the casing when the removable fitting is in place.

A feature of the invention consists in the employment of a single connector to hold the removable fitting in position in the lamp; and the invention also includes the removable fitting which constitutes the subject-matter of section (*c*) above.

Manufacturing Coal Gas.

WHITE, A. E.; a communication from the Riter-Conley Manufacturing Company, of Leetsdale, Penn., U.S.A.

No. 16,891; Dec. 1, 1915.

This apparatus for the manufacture of coal gas—of the kind in which the gas is cooled before it enters the take-off or hydraulic main—has for its object "to provide improvements in prior methods and apparatus for preventing the deposit of heavy hydrocarbons, tar and naphthalene, in the take-off main and apparatus beyond."

These heavy hydrocarbons and other impurities are removed upon discharging the gas from the stand-pipes, and before there is any opportunity for them to pass to the take-off main. The separation is preferably accomplished after the gas has attained such a temperature as results in fixing some of the lighter and enriching hydrocarbons into a permanent gaseous state, and which hydrocarbons, in the absence of such temperature, would condense and be carried away by the tar. Approximately 1000° Fahr. is said to be an efficient temperature for fixing the lighter hydrocarbons into a permanent gaseous state, although it may be higher, and even lower temperatures may suffice. In order to deliver and maintain a substantially uniform quality of gas to the take-off main, the gas discharging from the stand-pipe may be maintained at a relatively constant temperature, which is accomplished "by allotting a proper number of retorts to each stand-pipe and by so alternating or arranging the retort-charging periods that the resultant of low temperature of the product of freshly-charged retorts and the maximum temperature of the product of other retorts will be a uniform temperature, and preferably an efficient fixed high temperature."

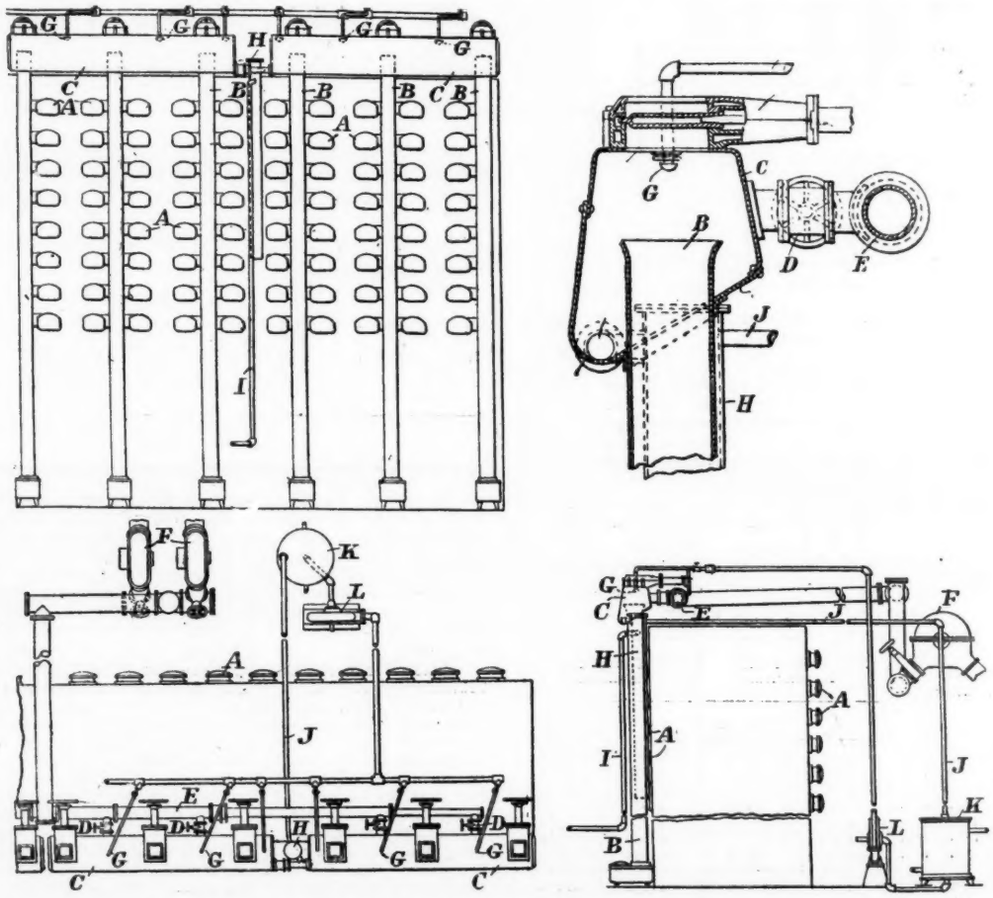
In the preferred mode of carrying out the proposal—the requisite high temperature having been attained and the lighter hydrocarbons thereby fixed into permanent gaseous state before discharging from the stand-pipe—a reduction of the temperature of the gaseous fluid immediately upon issuing from the stand-pipe is effected. The temperature should, it is said, be reduced to between 110° and 125° Fahr. for the best results; and, in accordance with a further feature of the invention, a device is interposed between the stand-pipes and the take-off main for accomplishing this immediate temperature reduction.

A front elevation is given of the preferred form of plant to carry out the proposal; also a top plan, an end view, and a cross-section of one of the cooling chambers.

The gas generated in the retorts A passes into stand-pipes B, which discharge into chambers C, the bottoms of which are inclined to form troughs, with the stand-pipes projecting through and above the inclined bottom to exclude the liquid accumulation in the trough. The gas passes out of the chambers C, through valved outlets D, to the take-off main E connected to the twin exhausters F for delivering the gas to other portions of the apparatus in the usual manner. The gas passes into the chambers C at a temperature approximating 1000° Fahr., and is there cooled by liquid from the spray devices G located out of vertical alignment with the stand-pipes, so as to avoid liquid from the spray passing into the stand-pipes. The water from the troughs passes to a tar-separator H, from which the tar discharges through a pipe I, and the liquid through the pipe to the cooler K, the liquid being forced from the latter by the pump through pipes to the spray devices G. This constitutes a closed circulating system which is preferably employed, "as thereby much ammonia is saved as compared with a fresh-water circulation, for the reason that after the cooling medium has become saturated, no additional ammonia is extracted from the gaseous fluid being treated."

Each chamber C is preferably arranged to accommodate three stand-pipes; and no difficulty has been experienced it is said in "maintaining the desired highly efficient conditions, above described." This arrangement provides for accurately controlling the withdrawal of the cleansed and cooled gas through the valved outlets D to the take-off main E, the valves of the connections being so adjusted as to subject all the cooled and cleansed gas to uniform exit force, with the result that no portion of the gas is retained within the chamber for an appreciably longer period than any other portion of it.

In operation—the gases in the stand-pipes being maintained at a uniform temperature of approximately 1000° Fahr. in the manner explained—the lighter hydrocarbons are fixed into permanent gaseous state, thereby materially enriching the ultimately cleansed gas, re-



A Riter-Conley Company's "Gas Manufacture" Plant.

taining in the latter valuable products which, in prior methods, have been disassociated from the main body of gas and virtually lost.

The immediate cooling of the stand-pipe output, which prevents any accumulation of solids in the take-off main and apparatus beyond, is accomplished by the liquid sprays which the gaseous fluid encounters immediately upon emerging from the stand-pipes; the operation being preferably such that its temperature is reduced to between 110° and 125° Fahr. This temperature reduction results in precipitating the major portion of the tar and also nearly all the naphthalene; the latter combining with the tar and the condensates, and the cooling liquid draining into the troughs and discharging to the separator H.

Regenerative Furnaces.—No. 101,983.

DRAKES LIMITED and W. A. DRAKE, of Halifax.

No. 7; Jan. 3, 1916.

This invention relates to furnaces used in connection with horizontal or inclined retorts, where the hot waste gases on their way to the chimney are arranged to travel through descending flues connected by horizontal flues, while the secondary air travels vertically along flues which adjoin, and more or less surround, the horizontal

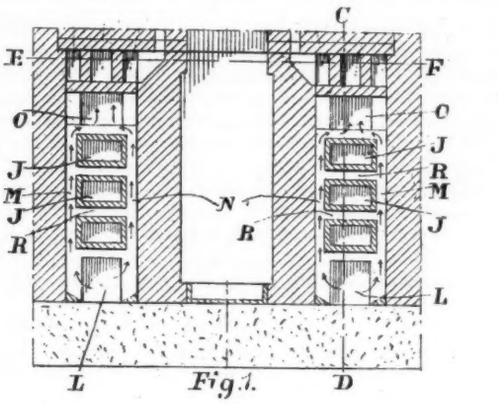


Fig.1.

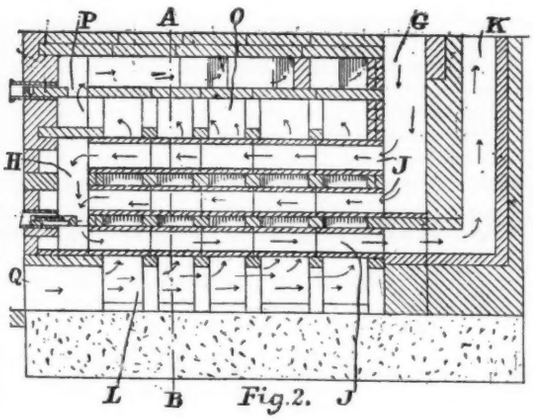


Fig.2.

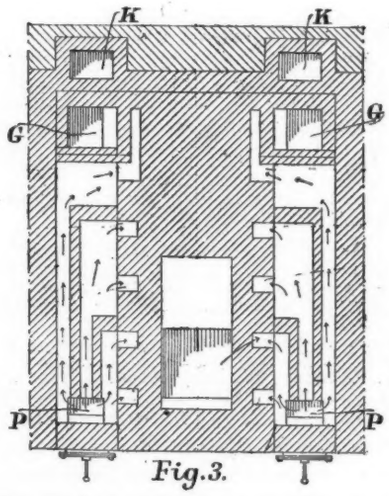


Fig.3.

Drakes' Regenerative Furnaces for Horizontal or Vertical Retorts.

flues. The proposal is to arrange the regenerator flues so that the controlling of the secondary air may be effected at its egress from a chamber common to the whole series of flues, by which arrangement it is said that "greater power of control and the efficiency of the regenerator is enhanced."

Fig. 1 is a cross sectional elevation of the furnace on the line A B of fig. 2; fig. 2 is a longitudinal sectional elevation on the line C D of fig. 1; fig. 3 is a sectional plan on the line E F of fig. 1.

In carrying the invention into effect, use is made of the usual and known arrangements of vertical and horizontal flues G, H, I, through which the waste gases have to pass on their way to the chimney or uptake K. In connection with these flues there are flues L, which cause the secondary air to travel over the outer surfaces of the waste-gas flues I in known manner, but both series of flues may be modified in construction.

The series of secondary air flues L, M, N terminate in a common chamber O at or near their upper ends. This chamber is preferably formed and arranged to be of such dimensions as to permit the outlet or outlets P to be adjoining the outer wall of the structure in order that there may be mounted therein a damper for controlling the flow of the secondary air from the chamber O. Or a single damper for each flue may be provided. By the secondary air being thus controlled on its egress from the chamber O, the speed at which it travels will be greatest at and near its outlet, for the reason that its expansion by heat will be greatest at this part. Hence, the secondary air as it enters the lower end Q of its conducting flues does not travel at such a speed as will enable it to gather up and carry with it dust, light ashes, &c., "as is the case under former conditions." Further than this, as the withdrawal of the secondary air from its flues is at the highest parts, the secondary air flues, instead of having deflecting or guiding partitions, may be left open to form approximately straight and uninterrupted vertical passages for the secondary air, while yet the cross passages R may be retained and open into the vertical flues on each side of the waste-gas flues.

Manufacture of Phenol.—No. 101,807.

TYRER, D., of Stockton-on-Tees.

No. 522; Jan. 12, 1916.

The manufacture of phenol involves three principal processes: (1) Sulphonating benzene to the mono-sulphonic acid; (2) converting this acid into alkali phenol; (3) liberating the phenol from the alkali phenol. This invention relates to improvements in the second of these processes; and the claims made for it are: (1) Adding to the mixture of benzenesulphonic acid and sulphuric acid a proportion of a base forming an insoluble sulphate, sufficient to convert the acids into sulphonate and sulphate respectively, and to neutralize a quantity of nitre cake or other form of sodium bisulphate equivalent to the sulphonic acid, and then adding a specified quantity of nitre cake. (2) A modification in which the proportion of base and nitre cake or bisulphate added is sufficient for producing in the mixture some or the whole of the caustic soda requisite for subsequently converting the sodium benzene-sulphonate into sodium phenol—the mixture being heated, if necessary, under pressure.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 29.]

Nos. 16,583—16,952.

BAKER, H.—"Extraction of cyanides from ammoniacal liquor, &c." No. 16,906.
BRAYSHAW, E. R. & S. N.—"Furnaces." No. 16,662.
CLELAND, J.—"Pressure reducing valves." No. 16,607.
DAVIS, H. N.—"Burners for furnaces, fires, ovens, &c." No. 16,886.
DIGGLE, S.—"Regenerative combustion of waste products of coal, &c." No. 16,854.
HELPS, G.—"Utilization and combustion of fuel." No. 16,709.
HELPS, G.—"Gas manufacture." No. 16,845.
HOWARD, G.—"Gas cooking appliances." No. 16,796.
JACKSON, J.—"Pipe connection." No. 16,583.
MANDLE, H. H.—"Production of light oils from heavier oils." No. 16,894.
MITCHELL, J.—"Governors for blowers or exhausters." No. 16,638.
PHILIP, A.—"Detecting presence of combustible gases." No. 16,750.
REEVES, E. A.—"Mixing gas and air." No. 16,824.
ROXBURGH, A. B.—"Gas-producers." No. 16,864.
SCOTT, G. B.—See Diggle. No. 16,854.
SHILL, A. E.—See Diggle. No. 16,854.
STEELE, L. J.—See Philip. No. 16,750.
STEWART, J. C.—See Cleland. No. 16,607.
TWIGG, W. R.—See Davis. No. 16,886.
TYNE GLASS WORKS.—See Roxburgh. No. 16,864.
YATES, H. J.—"Furnaces." No. 16,662.

Birmingham Corporation Workers' Wages.—The Labour Committee of the Birmingham City Council have had before them the award of the Committee on Production of 2s. 6d. per week each to all the workmen employed by the Gas, Electric Supply, Tramways, and Water Departments, which are certified under the Munitions Act. The result of the arbitration will be reported to the Council; and the Committee will also recommend that the award, though technically limited to the four certified departments, shall apply to the non-certified departments as regards manual workers. The number of men affected by the award in all departments is 8500; and the increase represents about £55,482 per annum, which is equivalent to a rate of something like 3½d. in the pound. As to a similar application made by the clerks and officials, the Committee ask the Council for their direction.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Sulphate of Ammonia: Further Definite Proofs of its Advantages in Agriculture.

SIR,—It may be of interest to your readers to learn that since I read a paper on "Lime and Sulphate of Ammonia as Fertilizers," before the Institution of Gas Engineers at Liverpool in 1914, persistent experiments have been made at Bushton Farm, Tutbury, and these have proved most satisfactory.

This year my son has been awarded five first-class prizes for his crops of mangolds—including the first prize offered by the Sulphate of Ammonia Association of Great Britain. The quantity produced per acre was 90 tons 2 cwt. 2 qrs. and 20 lbs.

It may be interesting to state the progress that has been made in the production of mangolds since sulphate of ammonia and other artificial manures were first applied:

Year.	Yield per Acre. Tons.	Cwt.	Qrs.	Lbs.	Remarks.
1909	34	0	0	0	Ordinary artificial manures.
1910	45	0	0	0	
1911	47	0	0	0	
1912	42	0	0	0	
1913	57	10	0	0	Sulphate of ammonia and superphosphates.
1914	60	0	0	0	
1915	72	0	0	0	
1916	90	2	2	20	

During the current year there has also been produced, chiefly by the aid of sulphate of ammonia, a much larger crop of hay—94 tons being obtained from 30 acres of land, or 3 tons 2 cwt. 2 qrs. per acre. When the experts carried out the first experiments in the year 1912, comparisons were made between the results obtained with the ordinary farmyard manure, sulphate of ammonia, and other manures.

The hay crop got from the field dressed with farmyard manure was 1 ton 9 cwt. 3 qrs. 8 lbs. per acre; and in part of the same field, by the application of sulphate of ammonia and other fertilizers, 2 tons 14 cwt. 1 qr. 12 lbs. So that it will be seen that the weight of hay has been more than doubled this year. The pastures have also been very much improved.

The above facts, and the present condition of the land, totally disprove the prevailing idea that artificial manures impoverish land.

With good farming, one can keep more cows. Consequently there is more farmyard manure to return to the land; and this when supplemented judiciously with sulphate of ammonia very materially improves the condition of the soil, as is clearly proved on this farm, as every year more sulphate of ammonia has been employed and the land has very much improved in consequence.

The figures given here are those obtained by the appointed judges.

Southport, Nov. 30, 1916. JOHN WEST.

Prepayment Meter Agreements.

SIR,—In the report of "A Prepayment Meter Dispute," p. 454, and emphasized in your "Editorial," p. 431 of your issue of the 28th ult., on the same subject, occurs the passage that the plaintiff having signed an agreement promptly forgot all about it.

One is curious to know if a copy of the signed agreement was supplied to the applicant; and, if not, how on earth a gas authority expects an applicant to do other than forget?

Few gas authorities—at least, in the writer's experience—do supply such copies. Should it not be obligatory upon them to do so? Then an applicant can have absolutely no excuse for not being aware of the terms of his contract.

J. F. TYNDALL.

Whitchurch, Salop, Dec. 2, 1916.

Mr. Wilson's Benzol-Recovery Paper.

SIR,—I regret to notice that your report of the discussion on my paper, "Some Points in Connection with Benzol Recovery," is very inaccurate in many particulars. I will leave other members who took part in the proceedings to point out for themselves, if they think fit, the mistakes I know to have been made in reporting their questions; but as, owing to my being the author of the paper, I figure prominently in the discussion, I must ask you to make public the following corrections, which deal with the more important of the errors by your representative in the case of my replies to those questions.

In my reply to Mr. Price, I mentioned that on one of our two plants we had had trouble with the bristles choking-up the outlet of the rotary scrubber, but on the other plant this had not occurred—the difference being probably explained by the fact that on the one plant the connection from the rotary scrubber to the first tower scrubber is a somewhat tortuous one, which was not the case on the plant where no trouble was experienced. Your reporter leaves out this explanation, and inserts a sentence which carries no sense with it.

In alluding to the distillate obtained on the intermediate still from the 65 per cent. crude being lower than formerly owing to the very large amount of naphthalene in the oil, I mentioned that the extra quantity of naphthalene was due to the fact that one battery of our ovens was in a bad state of repair and was shortly to be relined, which is different to making me say that one oven was being relined.

In answering the question as to increase in toluol when working at a lower figure than 65 per cent. for the crude, I stated that I had not observed any increase, and added the information that our toluol was, at the present time, only about 9½ per cent. of the total products.

My reply to Mr. Taylor is cut down so that little, if any, sense can be made of parts of it, even if Mr. Taylor's remarks were correctly reported, which they are not.

With regard to working temperatures, what I actually said was that, with low gas temperatures, we found we could work successfully with a poor quality of wash-oil, but that we were liable, in doing so, to get solid deposits in the scrubbers and elsewhere.

In answering Mr. Lee, I said I was aware that he used less acid than we did at Staveley, and I had thought (as he did) that the difference might be due, initially, to the higher temperature we worked on our crude still. This again is rather different from the remark your reporter credits (or discredits) me with making. Nor yet did I say that we "first of all washed for 90's for the slender (?) benzol, and then washed again for the standard benzol." On the contrary, I explained that the 3½ per cent. was the acid required for washing standard benzol for pure, and that our procedure was first of all to wash-out the light oil for standard benzol and then to wash again when making pure.

Part of my reply to Mr. Haigh has been left out, with the result that I am represented as giving the impossible figure of 85 per cent. recovery of finished products from 65 per cent. crude, whereas the 85 per cent. referred to the distillate obtained in the intermediate still with true 65 per cent. crude.

Finally the question of a preliminary washer to intercept any tarry matters brought forward to the benzol scrubbers was first mentioned by another member, and only agreed to by me as a good suggestion, though I certainly should not think of throwing away the oil from such a vessel when rejecting it, as might be thought from the report.

Chesterfield, Nov. 30, 1916. J. A. WILSON.

[We regret exceedingly the occasion for Mr. Wilson's letter, and more especially as other communications have been received also complaining of the writers having been misreported by one of our local representatives. Every effort is made by us to secure accuracy in reporting; but long experience assures that the fault for the contrary is not always on the side of the reporter. In this instance, our representative states that note-taking was especially difficult owing to the conversational manner in which the discussion was conducted, and to some of the speakers being indistinct. We cannot, however, accept this, and offer it as an explanation of all the points referred to by Mr. Wilson, as, in the light of his letter, it is plain that certain passages of our report of his remarks are quite devoid of the intended meaning. But so far as our representative's remarks apply, it is to be hoped that the members of the Association will see to it that they contribute to the production of satisfactory reports in future by clearness of expression and by set speeches free from interjected remarks. The best thing to be done on this occasion, in order to correct misrepresentation, is to ask the various speakers in the discussion to kindly revise the report of their remarks, and then for us to republish it in an early issue. It is hoped that, while regretting that the report with the blemishes complained of should have been circulated, this will set the matter right, and that, by the aid of the speakers in future discussions, there will be no cause for serious complaint.—ED. J.G.L.]

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Control of the South Wales Coalfield.

Mr. ALDEN last Thursday asked whether the Government had yet considered the advisability of taking over the South Wales mines by the State, in order to eliminate war profits, to avoid industrial disputes during the war, and to secure the best results from the labour of the miners.

Mr. RUNCIMAN pointed out that a regulation had been made empowering the Board of Trade, so far as they considered necessary for the national safety and the defence of the realm, to take possession of coal mines, either generally or in any particular area. The Board of Trade had already made an order applying the regulation to the coal mines in South Wales and Monmouthshire, in the confident belief that this action would secure the advantages set out in the question.

Mr. SNOWDEN: Is it intended, under this arrangement, that the coalowners should be guaranteed a fixed profit, and that any increased wages will be borne by the general community?

Mr. RUNCIMAN: I cannot make any statement at present as to the financial arrangement that will be arrived at.

Pressure of Gas at the Crystal Palace.

Mr. RENDALL asked whether it was a fact that much discomfort was caused at the Admiralty's Crystal Palace Training School by the low pressure of gas, which often interfered with the proper heating of the premises.

Dr. MACNAMARA: No complaint has been received of discomfort caused by improper gas heating. The gas is supplied by the South Suburban Gas Company; and the pressure is ample. Defects occasionally arise due to obstructions forming in the pipes and connections, especially in very cold weather; but remedial measures are immediately taken.

Mr. RENDALL asked that inquiry should be made into the matter.

The Dewsbury Gas and Water Committees, through the Town Clerk, last week drew attention, by official notice, to the necessity of protecting exposed gas and water meters, and lead and other pipes, by having them covered to prevent bursts from freezing and the consequent waste of gas and water. It is pointed out that, owing to the shortage of plumbers, it will be impossible during the winter to have pipes promptly repaired.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

Report of the Directors.

In submitting the accounts for the twelve months ended June 30 last [which will be presented to the proprietors at the meeting next Monday], the Directors report that the adverse conditions arising out of the war, to which reference was made in the last report, have continued in an aggravated form. Freights to French and Italian ports reached extraordinary figures, while the high costs of coal were further increased, with the result that no dividends have been received in respect of the greater part of the Company's investments, which are chiefly in Continental gas industries.

The balance at the credit of the profit and loss account on June 30, 1915, was £20,301. And after crediting such interests and dividends as were received, and deducting management and pension charges and income-tax, this balance was increased to £23,301.

The heavy costs of coal and freight to which the Compagnie L'Union des Gaz have been exposed since the commencement of the war, have not only prevented the declaration of any further dividends, but have rendered necessary the indefinite postponement of the final dividends declared in 1914, amounting on this Company's holding to £29,967, and the absorption of the profit balance then carried forward. As the realization of the balance at the credit of the profit and loss account depends on the collection of these dividends, the Directors have deemed it advisable to transfer it for the present to a foreign dividends suspense account. This in no way affects the Company's claim to the French dividends, if and when the Compagnie L'Union des Gaz are in a position to distribute them.

Arrangements have been arrived at lately between the British and the French and Italian Governments which should tend to reduce the very high freights to French and Italian ports, and to some extent also the price of coal. It is hoped that these arrangements will benefit the Company's large Continental interests, which have been unproductive since the outbreak of the war. The position should be mitigated further by governmental and municipal authorizations providing for an increase in the price of gas, beyond that fixed by contract, in various towns in Italy and France.

WELSBACH LIGHT COMPANY, LIMITED.

Getting Rid of the Austrian and German Interests.

Separate meetings of the holders of debenture stock and the shareholders in the Company were held last Tuesday at Winchester House, London, by order of the Court, for the purpose of considering and, if thought fit, approving (with or without modification) a scheme of arrangement proposed to be made, in connection with an agreement entered into with the consent of the Government between the Company and the Deutsche Gasgluhlicht Aktiengesellschaft (Auergesellschaft), called the "D.G.A." The salient points of the scheme were indicated on p. 457 of last week's "JOURNAL." Mr. J. R. YATES (the Chairman of the Company) presided, and explained at length the details of the proposals which those present were asked to sanction.

The SECRETARY (Mr. E. J. Butcher) having read the notice convening the meetings,

The CHAIRMAN said he supposed that few, if any, Boards of Directors had had since the commencement of the war more difficulties to tackle than had confronted the Directors and the management of this Company. But whenever recurring problems as to raw material, labour, finance, &c., had been met, there had always remained what he might almost call two nightmares—the precarious and unwieldy Austrian investment on the one hand, and the shares in the Company acquired by the concern known as the "D.G.A." on the other. The Austrian investment—the biggest individual asset that they possessed—was, of course, a legacy from the old Welsbach Company. The dividends, which at one time reached something like 75 per cent., had dwindled to very small proportions; and during the war no dividends at all could be received. On the contrary, they had constant fears, not merely of depreciation and loss, but of confiscation of the business. This would remain the position, unless the agreement now before them was confirmed. Then they had to consider the holdings of the "D.G.A.," amounting to 173,048 shares and £62,597 of debenture stock. Early in the year, they approached the Government Departments concerned; and from that time to the present, they had acted in close touch with them. Eventually, the Board of Trade authorized negotiations through neutral channels with the "D.G.A.;" and Mr. Charles Lock (a Director) undertook the arduous task of proceeding to Berne and conducting operations on their behalf. He had to express their deep appreciation of Mr. Lock's efforts. On receipt of the terms of the agreement, they were placed before the Government Department; and on Nov. 7 the Directors were given oral assurance that they might go ahead. Within a dozen working days of that time, the scheme had been worked out, and the necessary guarantee of subscriptions had been secured. The whole basis rested on these subscriptions, because they could not satisfy the debenture holders without selling the shares they proposed to sell; and the Court would not sanction the scheme unless assured of the ability of the Company to carry it out. The depleted secretarial staff had worked very hard to get the matter through. He then proceeded to deal with the salient features of the agreement and the scheme submitted to the share and debenture holders, and pointed out the effect which what they were now contemplating would have on future balance-sheets. The scheme would, he said, reduce the issued share capital to £175,000, and the debenture stock even at the outset to £139,000, and they hoped soon to £100,000. On the other side, they would get rid of the Austrian investment, and derive financial benefits which would, he was sure they would all agree, give them a much cleaner balance-sheet. The profits, on the basis of the last year, should allow readily for the provision of the debenture service, and yield a quite reasonable return over and above this. A three-fourths majority of those present in person or by proxy was required to carry the scheme.

Mr. CHARLES LOCK emphasized the importance of the decision they had to arrive at. Recognizing the disadvantageous position in which they would have otherwise found themselves, the Board opened up the negotiations for an exchange of interests, so that the assets in Austria (which had been of no use to them for three years) might be realized, and give the share and debenture holders something tangible to take its place. The Austrian assets stood in the balance-sheet at £179,000; while the nominal value of the securities they would get in exchange was something like £250,000. The advantage was therefore on the side of this Company. They must discount this, however, by the fact that some of the shares taken over were to be sold at 11s., which would reduce the total to about £208,000. Seeing that for the past three years the dividend which had been declared on the Austrian shares had averaged 5 per cent. per annum, he thought the shares, so far from being worth £150 per cent. of their face-value, at which they stood in the books, were not worth more than the par value. But they did not get the dividends, which were retained in Vienna; and then, again, the Austrian exchange was at a discount of 40 per cent., so that assets of a nominal value of £120,000 represented an actual value of £72,000. Under the scheme, the debenture holders would be secured more than twice over, and this by assets and securities entirely under the control of the Board in this country. The result would thus be to very much improve the position of the debenture holders; and, having regard to all the circumstances, the shares would be rescued from a position which might have proved very disastrous. By the scheme, assets would be provided for the shareholders of nearly 20s. in the pound; and the Company would be freed from every alien influence. For some years the revenue had been on the up-grade; and assuming the profits were maintained at last year's figure, the prospects were certainly fairly encouraging. With the interest from the proposed investment in Exchequer bonds and revenue from other sources they might have next year, say, £31,855, subject to income-tax and excess profits duty. Against this, assuming the debentures were not reduced below £139,000, they would have to provide £6283 for interest; redemption fund would take £4000, and a 5 per cent. dividend on £175,000 of share capital would require £8750, making a total of £19,033, against £31,855 on the other side. The business was being well maintained, and was under the capable management of Mr. B. Cars and Mr. Robert Cars.

Before the voting took place, there was some discussion; a number of questions being asked and answered.

Mr. L. FLETCHER, in the course of some criticism on certain points (apart from which he expressed agreement with the scheme), remarked that for thirty years the Austrian Company had been amassing residues from monazite sand; and it had been said that they had discovered a substance known as mesothorium, of enormous value, as being a specific for cancer. This was a potential asset which they were surrendering. The Board must have made arrangements for a supply of monazite sand and the manufacture of thorium from it, or for a supply of thorium nitrate, if the business was to be maintained.

The CHAIRMAN, in reply, said that whatever accumulations the Austrian Company might have were not available on this side now; and they could not possibly exercise from London any great control of things in Austria. The Company had every reason to anticipate that they would get all the supplies of thorium they might require.

It is understood that the scheme was carried unanimously, except for the vote of a holder of some £20 of debenture stock.

EDINBURGH GAS-WORKERS' WAGES.

Comparison with Other Scottish Towns.

In a recent number of the "JOURNAL" [*ante*, p. 305], it was reported that the workmen employed by the Edinburgh and Leith Gas Commissioners had, through the medium of the National Union of Corporation Workers, made certain requests for increased wages, &c., and that the Commissioners, after hearing a deputation from the Union, had given instructions for particulars to be obtained as to the rates of pay to gas workers in Glasgow, Dundee, Aberdeen, and Paisley.

In a long report, the Engineer (Mr. Alexander Masterton) now deals exhaustively with the whole subject. He remarks that it was suggested to the deputation that, if the retort-house men were granted extra remuneration, they might, as a *quid pro quo*, attend to a larger number of retorts, as at present the actual work per eight-hour shift did not occupy more than four hours. The men's representatives replied that their instructions were against this proposal. This attitude leads Mr. Masterton to observe that the provision of suitable labour for the retort-house during the winter is becoming a somewhat serious question; and as the military have recommended the withdrawal of the badges from some of the men employed therein, it looks as if it will be necessary to give urgent consideration to the suggestion to increase the number of retorts per man. Otherwise the maintenance of the full supply of gas will be jeopardized. Should it not be possible to bring about a friendly arrangement, Mr. Masterton is of opinion that the matter will have to be referred to the Board of Trade for arbitration, and the military approached for assistance.

The Commissioners also proposed to the deputation that the rates of wages to be paid to the different classes of their men should be the average of those ruling at Glasgow, Dundee, Aberdeen, and Paisley, and that all the benefits at present granted by the Commissioners—such as holidays with full pay, sick allowances, &c.—should be discontinued; the average figures to be increased or reduced as conditions, values, &c., varied. Mr. Masterton does not say how this offer was received; but he proceeds to give a mass of details as to the wages now paid in

Edinburgh and in the four towns named. Of this, a summary is appended, giving the Edinburgh rates and the average rates respectively.

Occupation.	Rate per Hour, including Bonuses.		Occupation.	Rate per Hour, including Bonuses.	
	Edinburgh.	Average of Four Towns.		Edinburgh.	Average of Four Towns.
	d.	d.		d.	d.
Chargers, drawers, &c.	9·21	9·22	Retort patchers	8·06	7·83
Conveyor and elevator men	7·91	7·79	Mechanics' labourers	7·56	7·32
Coal breakers and enginemen	7·91	7·89	Hammermen	7·56	7·51
Cranemen	7·91	8·5	Machine & handymen	8·06	7·67
Coke trimmers	7·23	8·04	Gas-fitters' labourers	7·06	7·38
Railway shunters	7·23	7·73	Mainlayers (leading)	8·82	8·24
Locomotive drivers	8·32	7·92	Do. (ordinary)	8 32	8·02
Sulphate of ammonia makers	8·32	8·18	Service layers	8·06	7·92
Do. assistants	7·1	7·51	Pipe jointers	7·56	7·80
Yard labourers	7·1	7·23	Main and service pipe labourers	7·06	7·07
General do.	7·06	7·22	Meter readers, per week	38/6	39/8
Purifier men	8·06	7·48			

As to overtime, holidays, &c., the following particulars are given:

Overtime.

	Edinburgh.	Glasgow.	Dundee.	Aberdeen.	Paisley.
Shift men	Time-and-a-third for twelve hours on one Sunday every three weeks.	Time-and-a-half for eight hours on one Sunday every three weeks. Sunday labour suspended 6 a.m. to 2 p.m.	No extra pay for Sundays.	Time-and-a-half for eight hours on one Sunday every three weeks.	Time-and-a-half for eight hours on one Sunday every three weeks. Sunday labour suspended 6 a.m. to 2 p.m.
Ordinary Day-Work men	WORKS. Sunday, time-and-a-third. Week days, time-and-a-quarter to 10 p.m.; time-and-a-half thereafter. DISTRIBUTION DEPARTMENT. Sunday, time-and-a-half. Week days, time-and-a-quarter to midnight; time-and-a-half thereafter.	Time-and-a-half.	Time-and-a-half.	Sunday, time-and-a-half. Week days, time-and-a-quarter.	Sunday, time-and-a-half. Week days, time-and-a-quarter.

Holidays Per Annum (With Pay).

Edinburgh.	Glasgow.	Dundee.	Aberdeen.	Paisley.
10 days	6 days	6 days	Shift men, 6 days. Ordinary day-work men, 4½ days	Retort-house men, 7 days. Other men at works, 10½ days. Distribution Department, 12½ days.

Sick Allowance Per Annum.

Three weeks' full pay, and three weeks' half pay, less Insurance payments	No allowance for sickness.

Out of the five towns, Edinburgh is the only one where a superannuation scheme is in operation; the employees contributing 2½ per cent. per annum on their wages, the Commissioners a like amount, with a special annual contribution of £2035.

Mr. Masterton concludes by saying that there do not appear to be any good grounds for the all-round advance asked for, or for an increase in overtime rates; and that if the Commissioners concur with this view, and it is not accepted by the Union, the matter can be referred to the Board of Trade.

The Commissioners supported their Engineer; and the upshot is that the question is shortly to go before an Arbitrator in the person of Sheriff Louttit Laing, of Aberdeen, who adjudicated some months ago with reference to the wages of the boiler attendants at the works.

PRICE OF GAS IN BIRMINGHAM.

A Proposed Increase.

In June, 1915, the Birmingham City Council sanctioned the price of gas being increased by 3d. per 1000 cubic feet; and at that time the Committee hoped it would not be necessary to ask for the price to be further raised. The continued advance in the price of gas oil and stores of all descriptions, and the very large increase in the wages bill of the department, coupled with the heavy cost of coal, and the increasing amount paid to the dependants of employees serving with the Colours, however, make a further increase in the price of gas imperative.

While the burdens of the department are steadily increasing, owing to circumstances entirely beyond their control, the Committee report that they have observed with much concern indications which point to a decrease in the receipts from gas. The income from consumers paying the higher rates in the scale of charges is, owing to economy on the part of householders, the restrictions as to lighting, and the earlier closing of shops, showing a marked decrease; while, on the other hand, the consumption of gas for manufacturing and power purposes, which at the lower rates is not now profitable, is increasing. The result is that, owing to the large all-round increase in manufacturing and other charges, it is impossible to make and distribute gas at a profit to all consumers under the present scale. The Committee will therefore recommend the Council at to-day's meeting to make the following increase in the scale of charges, as from the December reading of the meters.

FOR LIGHTING, COOKING, AND DOMESTIC PURPOSES IN ONE PREMISES.

	Per 1000 c. ft.
Up to and including—	
100,000 c. ft. per quarter	from 2/3 to 2/4
Quantity in excess of—	
100,000 c. ft. up to 500,000 c. ft. per quarter	,, 2/2 to 2/3
500,000 c. ft. up to 1,000,000 c. ft.	,, 2/1 to 2/2
1,000,000 c. ft. up to 2,000,000 c. ft.	,, 1/11 to 2/1
2,000,000 c. ft. up to 3,000,000 c. ft.	,, 1/9 to 2/–
3,000,000 c. ft. up to 4,000,000 c. ft.	,, 1/7 to 1/11
4,000,000 c. ft. per quarter	,, 1/6 to 1/10

FOR MANUFACTURING AND MOTIVE POWER IN ONE PREMISES.

	Per 1000 c. ft.
Up to and including—	
1,000,000 c. ft. per quarter	from 1/10 to 2/–
Quantity in excess of—	
1,000,000 c. ft. up to 2,000,000 c. ft. per quarter	,, 1/8 to 1/11
2,000,000 c. ft. per quarter	,, 1/6 to 1/10

Subject to 5 per cent. discount for prompt payment.

PREPAYMENT CONSUMERS.

The Committee will also recommend that the quantity of gas supplied through prepayment meters be reduced, as from the same time—

With gas fittings and cookers free, from 31 to 30 cubic feet per penny.
With cookers only free ,, 35 to 34 ,, ,, ,,

Interviewed by the "Birmingham Daily Post," Alderman Sir Hallewell Rogers (the Chairman of the Committee) said the proposed increase was due very largely to freightage, and to the difficulty of the oil companies in obtaining tank-steamers. Coal had been advanced in price, the department had labour difficulties to face because so many of their skilled men had joined the services and they had been replaced by unskilled men, and all stores had enormously increased in cost. The Summer Time Act had operated adversely to their interests, because the consumption of gas for shop and house lighting during the summer had decreased; and there was a further decrease through the earlier closing of shops and the restriction of lighting in the city generally. The department had now to pay another 2s. 6d. a week under the Arbitrator's recent award to each of their workmen—representing a sum of about £12,500 a year; and this was in addition to the increase in the wages of the workmen of 2s. per week granted by the Corporation in February last. They also had an increasing sum to pay to the dependants of those men who had gone to the war; the sum on this account for the year being about £40,000. The Committee had prepared an estimate of ways and means; and they found that at the end of March next it was probable, with all the extra expenses involved in the undertaking, they would not only not be able to contribute anything to the rates, but would have a deficit on their own accounts. Consequently, they had to consider how the extra money that would be required should be obtained; and they came to the conclusion that it was advisable to ask the Council to allow them to increase the price of gas from the next reading of the meters. By this means, they would reap the advantage of an increase in the charges for the last quarter of the financial year, when it was hoped they would be in a position to contribute to the rates a similar sum to that given last year—namely, about £26,000. In arranging the increased charges, the Committee thought it would be unfair to penalize the smaller consumers at the present time, especially as the low rates now charged to the large manufacturing concerns could not be justified. A penny per 1000 cubic feet would be added to the scale of charges for the small consumers; and the increases varied up to 4d. per 1000 feet in the case of the largest manufacturing consumers. The charge for gas supplied through prepayment meters would also be increased by an amount which was equal to 1d. per 1000 cubic feet.

Increased charges for electric current are also recommended.

Chertsey Gas Company.—The non-lighting of the public lamps and the Summer Time Act affected the demand for gas at Chertsey in the past financial year; but satisfactory returns from residual products enabled the Directors to recommend the same dividend as last year. Altogether the sale of gas was 5 million cubic feet less.

LEIGH GAS AND WATER ACCOUNTS.

Mr. F. Bowen, who last April took up the position of Engineer and Manager to the Leigh Corporation Gas and Water Departments, has submitted to the Gas and Water Committee his report for the year ended March 31.

The figures show a net profit on the gas-works of £1171. The allowances to employees on military service equal ½d. per 1000 cubic feet of gas; and this amount will be further increased during the current year. The total quantity of gas sold was 157,238,800 cubic feet, or 3,680,700 feet (equal to 2·39 per cent.) more than in the preceding year; while the make per ton of coal carbonized was 11,856 cubic feet, as compared with 10,800 feet. The total capital charges last year were £11,197, or 1s. 5·09d. per 1000 cubic feet of gas sold. The net cost into the holder per 1000 feet sold was 11·93d. Unaccounted-for gas figures at 7·02 per cent., as against 5·43 per cent. in 1915. This increase, Mr. Bowen says, is the direct consequence of the necessity for high pressures both day and night, which the requirements of gas for furnace work have compelled them to maintain. The cost of coal (owing to unexpired contracts) was 16s. 2½d. per ton; but for this year the average price will probably work out at 18s. 7½d. per ton.

The water revenue account for the year shows a loss of £573, as compared with a loss of £935 the previous year. This reduction is mainly due to a substantial increase in revenue from metered water.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

Additional Government Assistance.

A well-attended deputation from the Board of Scientific Societies waited upon Lord Crewe, Lord President of the Privy Council and President of the Committee of the Privy Council on Scientific and Industrial Research, at the Institution of Civil Engineers last Friday, to urge the claims of applied and industrial research for greater consideration on the part of the Government in the matter of financial assistance.

Sir J. J. THOMSON, F.R.S., the President of the Royal Society, spoke with regard to applied science, and Sir MAURICE FITZMAURICE, the President of the Institution of Civil Engineers and Chairman of the Sub-Committee of the Advisory Committee on Engineering, dealt with the industrial aspect of the subject. So far as this Committee was concerned, it had received a set-back for want of funds. He hoped that the Government would give the necessary stimulus to the work of the Committee by affording a greater measure of financial assistance in the future than it had done in the past.

Professor H. B. BAKER, in urging the cause of industrial research in chemistry, said there could be no doubt as to its importance. He reminded them that all but 1 per cent. of the sulphuric acid produced in this country was to-day made by a process invented by a quack doctor at the end of the Eighteenth Century, although there had been certain modifications in it as it was originally devised. Similarly, there were a vast number of smaller problems to be investigated, such as the utilization of bye-products, which was so carefully looked into in Germany. It was known that the bye-products of the manufacture of dyes in Germany were made into useful and valuable drugs—not things sold at (say) £100 a ton, but something like 6s. an ounce. These things indicated more and more the importance of research in chemistry in this country. There were two kinds of chemical research. The first was what might be called *ad hoc* research—research undertaken with the idea of improving some particular process for the utilization of some bye-product; but there were also problems which had no direct industrial aim. It was only since the war that there had been a coming together of the academic and manufacturing chemists in this country. Academic chemists had quite wrongly, no doubt, looked upon manufacturing chemists as rather intolerant to new ideas. They had thought, perhaps, that the manufacturing chemists wanted to make profits at once, and would not have research assistants at £300 a year unless they could see results in a year's time. Manufacturing chemists, perhaps, on the other hand, had taken just as mistaken a view with regard to the academic chemist—they thought that he was a pure visionary, and that he was concerned with things that had no bearing on the great manufacturing processes. This attitude he was happy to say was now disappearing. If more research could be carried out by collaboration between the manufacturers, the universities, and the college laboratories, an enormous advantage would be done to the whole of the chemical industry in this country.

Lord CREWE, replying to the deputation, said the funds at the disposal of the Council for the purpose of research came under three heads—namely, the provision of money by Parliament, the receipt of moneys from different parts of the Empire for the prosecution of certain researches, and the receipt of money from private benefactors. With regard to the latter, he had been told that two gentlemen had given handsome donations, and had expressed the hope that their example would be followed by others. As to the receipt of money from other parts of the Empire, this no doubt would be increased as the activities of the new Department became more widely known. Already some researches were in process of organization, even if they had not actually been begun, which were of practical interest to the overseas dominions. With regard to the provision of money from public funds, steps were being taken to bring about close co-operation between the leaders of the different industries in order to arrive at the form in which public money should be provided for research. The conclusion had been come to by the Government departments concerned that any system of granting a definite sum of money each year for the purpose of research would be hopeless, and the Chancellor of the Exchequer proposed to advise the Government to make an exception in this matter and to devote a very large sum, generally estimated to meet the needs in view for a period of the next five years, on a scale which would enable the expenditure to be four, and possibly five, times as much as had been already spent for the whole purpose of research hitherto. In order, however, to bring about adequate co-operation between the Government and private firms in this matter, the Government desired to see either the creation of new or the adaptation of existing trade associations on a large scale, which would be able to assess the provision which any particular industry would be able to make towards this systematic research. Some of these associations might be specially formed for the purpose; while in other cases (where great commercial associations for particular industries already existed) a branch of the association might easily be appointed specially devoted to the subject. In the case of the engineering industries, where there were a great variety of applications, it would probably be found possible to form a series of distinct associations for research purposes; and in this case an individual firm having various activities could select the association to which it would contribute in respect of any particular class of research at any given time. He had been informed that any subscriptions in this direction would be treated as working expenses for income-tax purposes. In addition to this sum, which was expected to last four or five years, the Government proposed to vote annually money for other purposes—such, for instance, as those cases in which an individual research worker needed a grant in order to enable him to get on with the problem he had in hand. There were also some scientific societies which stood in need from time to time of assistance to enable them to carry on research work; and such assistence would be given where necessary. As to the finances of the National Physical Laboratory, these would be given the most careful consideration by the Advisory Committee, because the value of the work done at Bushey Park was fully recognized. Closely related to the question of industrial research was technical school training; and it was proposed to discuss with the local authorities concerned certain new draft regulations. Further, special increases would be made to the estimates of the Board of Education for assisting local authorities managing technical schools. In addition, important arrangements would be made for the training of technical teachers and for granting scholarships in order to carry to the universities selected industrial students. With regard to the work of the Coal Conservation Committee, he understood that the Advisory Council and the Coal Committee had agreed upon the beginning of a series of researches to establish the scientific basis for systematic economy in the use of fuel. The intention was to begin with a chemical survey of the various coal measures of the United Kingdom, and to examine and experiment upon the different kinds of coal and to discover their suitability for different processes—such as coking and so on. He was not able to say at the moment on what principles finances for such an inquiry could be obtained, nor the system of contribution or non-contribution which should be applied to it in different instances.

ECONOMIC UTILIZATION OF COAL.

The Howard Lectures at the Royal Society of Arts.

At the Royal Society of Arts on Monday of last week, Professor J. S. S. Brame, Professor of Chemistry at the Royal Naval College, Greenwich, commenced a series of three Howard lectures dealing with "Coal and its Economic Utilization."

In introducing the lecturer, the Assistant-Secretary of the Society said that, although it was the first time he had appeared before the Society, Professor Brame hardly came as a stranger, because he hailed from the Royal Naval College, Greenwich, and so wore the mantle of an old friend, the late Professor Vivian B. Lewes.

Professor Brame said he had some feelings of emotion in respect of Professor Lewes, who was probably the most popular lecturer who had ever appeared before the Society, and to follow a man of such eloquence was extremely difficult.

Proceeding with his lecture, the Professor said the economic importance of coal was hardly recognized, yet it is the only raw material we produce in great quantities. The value of our mineral output in 1913—a year undisturbed by either labour or domestic troubles—was £160,000,000, of which coal represented £145,500,000. Our industrial supremacy had been built-up on our coal supplies; and the movement which had been inaugurated for economy in coal was by no means a new one. Professor Jevons called attention to it in his book in 1863; and numerous Royal Commissions had issued reports on the subject. More recently, the late Sir William Ramsay made it the subject of his Presidential Address to the British Association five or six years ago; and within the last few months energetic action had been taken through Professors Bone and Armstrong. The latter had endeavoured to galvanize industrial chemists into some action; and his recent instructive addresses to the sections of the Society of Chemical Industry were really worthy of consideration. Professor Bone had also expounded his views at great length before the Society of Chemical Industry and the Royal Institution, and through his energetic action the British Association Fuel Committee had been formed. The improvident use of coal was to a large extent due to its cheapness. The great public had remained absolutely untouched by the appeals of scientists who had addressed scientists already convinced. The war had brought home to the nation that coal was something more than a material merely to be burned. But, valuable as the results from the British Association Committee promised to be, he did not think any one Society could do very much. It was really a subject in which they must look for action on the part of all the learned and technical societies; and the Society of Arts, with its century and a half of educational work behind it, should take a prominent part in the movement to educate the public. It was in the hope of getting something done, and preventing the question again being shelved, that these lectures were being given before the Society.

After submitting figures of coal output in Great Britain from 1871 onwards, Professor Brame drew attention to our coal reserves, and the rate at which we are drawing upon them in relation to our great commercial rivals. He showed how Germany and the United States were now producing larger outputs than we were, were keeping a larger percentage of these outputs for their home consumption, and at

the same time were drawing at a less rapid rate per annum upon their calculated reserves. In dealing with this matter, however, it was not a question of exhaustion of supplies, but a question of the time when our easily won coal would be exhausted, and we should have to go deeper than we had been accustomed to. Coal would then become dear relatively to other commodities; and that day would see the decline of Great Britain as the leading industrial country of the world. Therefore, some means must be taken to economize, although many coal economists overlooked the fact that improved methods of utilizing coal for power purposes must tend to stimulate industries and eventually lead to an increased consumption.

In 1904, when Sir Thomas Beilby prepared figures for the Royal Commission on Coal, demonstrating possibilities of saving in fuel for power purposes, much reliance was placed upo- a very considerable extension of the use of gaseous fuel. The turbine was then in its infancy. To a large extent the anticipated increased use of larger gas plants had not come about, owing to the development of the steam-turbine. At the same time, sufficient credit was not given by economists to the economies both in the production and use of coal that had been effected during recent years.

Dealing with the question of the export of coal, Professor Brame remarked that if the political economists were right, and the export of coal was essential to our national well being, then we must realize that it must be at the expense of bringing nearer the day of dear coal. It was a matter requiring most careful consideration; and the time might be anticipated when it would be more economical to import part of our coal. He regarded the suggestion of a tax on export coal, the proceeds to be devoted to research work to discover more economical means of production and use, as a very sound proposition, and added that the public could not be educated too fully in regard to possible developments in the future. The question of the importation of coal and the larger question of the nationalization of mines must be decided some day; and it was not improbable that we should have to tax the export of coal out of existence in order to retain our industrial supremacy. The nation had the right to demand that the national resources should be dealt with in such a way as to safeguard its future prosperity. Hitherto private enterprise had been allowed to exploit coal in quite an unrestricted manner, subject only to safeguards for the miners.

Although much had been done, more still remained in order to put off the evil day of dear coal and industrial decline. He saw no hope of a substitute for coal, at any rate within a measurable distance of time. Oil had been looked upon as one; but the available oil supplies did not seem likely to outlast the coal supplies. Harnessing the tides, the use of water power, and the molecular disintegration of radium had been discussed; but they could all be put on one side. The fact was they must economize in every way possible; but he had no sympathy with the appeal for legislative action, such, for instance, as prohibiting the use of raw coal for domestic purposes. Parliamentary action could only be indirect, in the way of providing fuel-testing laboratories and the general advancement of scientific research and technical education. Means must be considered of production at the mines and economy in the use of coal, and, if necessary, reliance must be placed upon something other than the coal export trade for the maintenance of our foreign trade.

HOME USE OF SULPHATE OF AMMONIA.

Correspondence has been appearing in "The Times" on the subject of increasing the supplies of home-grown food; and in the course of it attention has naturally been directed to the importance of sulphate of ammonia in this respect.

Professor W. Somerville, of Oxford, wrote pointing out that sulphate of ammonia is by far the most valuable of home-produced manures. He said that this year the export is likely to be about 250,000 tons; and this, if used at home, would, in terms of wheat, have produced 2½ million quarters, which would have meant an increase of 30 per cent. on our home production. This home use of sulphate would also represent a saving of perhaps 800,000 tons in freight, reckoning both the export of the sulphate and the import of some sort of food. The mere prohibition of the export of sulphate of ammonia would not, he concluded, mean that farmers would voluntarily absorb our surplus supplies. To get them to do so would necessitate some kind of compulsion, which might take the form of local committees, armed with statutory powers, who would direct farmers to dress certain of their fields. Or the Boards of Agriculture returns of cropping might be used as a basis for distribution. Payment could be deferred till the crop was marketed; and even if prices slumped in the interval to something like pre-war rates, there would be no loss involved—rather a reduction of profits.

Replying to this letter, Mr. D. Milne Watson (the Chairman of the Sulphate of Ammonia Association), after admitting that without doubt a large part of the 250,000 tons exported this year could have been more profitably used at home, said: It is necessary to point out, however, that sulphate of ammonia is an absolutely essential factor in the production of sugar, and must needs be exported to sugar-producing countries if a sugar famine is to be avoided. When sugar requirements and the legitimate claims of British possessions and of our nearest Allies are taken into consideration, it will be found that rather less than one-half the quantity now exported could be made available for home use. The difficulty is not so much how to provide the quantities needed as to induce the farmer to take supplies as they become available. The Professor suggests that this problem should be solved by the payment for the sulphate of ammonia used by the farmer being deferred until the crop is marketed. In other works, he proposes that the sulphate of ammonia manufacturer should act as the banker to the farmer. Unfortunately, however, it is quite impossible for the manu-

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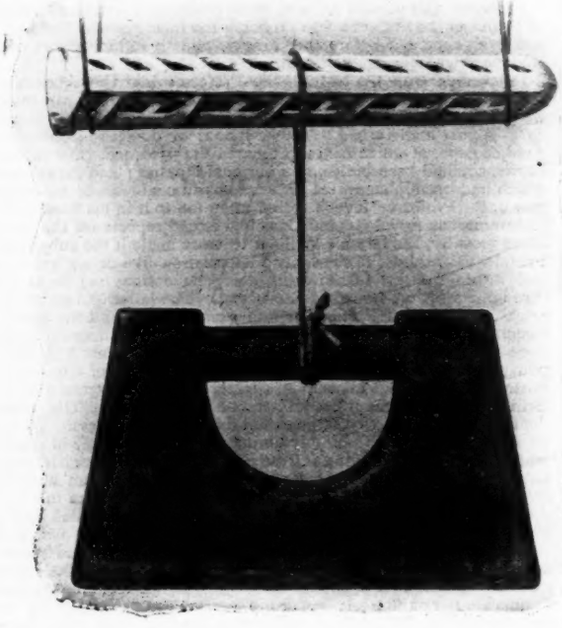

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facturer to do this for the farmer, as, under present conditions, the manufacture of sulphate of ammonia cannot be continued unless the producer is able to clear his stores and to turn his product into cash every month. Although technically a by-product, sulphate of ammonia, regarded financially, is a primary and vital consideration to a large majority of its producers. Any attempt to force an accumulation of stock at the works would result in the closing-down of plant, and consequently in a reduction of production and disastrous diminution in the supply of high explosives. In spite of the enormous increase in the cost of production, manufacturers have voluntarily agreed to make very considerable sacrifices, so that the farmer should have cheap sulphate of ammonia, and have agreed to supply home needs at a price considerably lower than last year's. The British farmer is thereby enabled to buy this fertilizer at about £6 per ton cheaper than his oversea brethren, though he is still allowed to take full advantage of the difficulties of the time in the high prices he obtains for his wheat, &c. Even so, he is showing little inclination to make the most of his opportunities. This is due chiefly to his ignorance, and to the neglect into which agriculture has been allowed to fall. Manufacturers of sulphate of ammonia have been most anxious for years past that the farmers should use sulphate of ammonia, and they have, for the last twenty years, spent some £10,000 a year on propaganda work, to prove to the farmer the beneficial effect of dressing his crops with this fertilizer. Before the war, the Government Department most concerned had ignored sulphate of ammonia; and it is only recently that it has awakened to the fact that in sulphate of ammonia we possess a home-made fertilizer of the highest value. If it is necessary, as Professor Somerville suggests, to stimulate the farmers' efforts by financial help, then the Government might do worse than consider the establishment of an Agricultural Credit Bank, whose chief function would be to furnish farmers with credit to enable them to purchase fertilizers, agricultural machinery, and seeds, &c. Many far-seeing people in this country who have watched the progress of Germany in agricultural matters have advocated such an institution; and this seems an opportune moment to establish such a bank. This would have a far more beneficial effect than exhortations by local committees. The sulphate of ammonia makers of the country are doing everything in their power to provide the necessary quantities of sulphate for the farmers for the use of agriculture.

In a further letter published yesterday, Professor Somerville says that this country's sugar at present comes mainly from the United States and Cuba; and these countries take but little of our sulphate of ammonia. He proceeds as follows: The Chairman's statement in regard to British farmers getting sulphate of ammonia cheaper this year than last does not coincide with official statements or with my experience. In the autumn of 1915, the Board of Agriculture arranged for supplies to be available for home use at £14 10s. per ton. At present, under a similar arrangement, the price is £15 10s. per ton. I fail to see how this is "a price considerably lower than last year's." Nor do I agree with the Chairman when he says the British farmer is getting his fertilizer £6 per ton cheaper than his oversea brethren. Last year the declared value of our exports of sulphate of ammonia averaged £13 10s. per ton f.o.b.; while British farmers were supposed to be getting a concession at £14 10s. per ton for autumn application—a time of the year when few farmers want to use it. This year the arrangement is relatively more favourable; the respective prices being £16 14s. and £15 10s. Probably before our exports reach some of the more distant purchasers they may have incurred freight and other charges amounting to £6 a ton, which only shows how desirable is the substance of which we are complacently starving British acres. But assuming that it is necessary for the cultivators of Java, Sumatra, Hawaii, Mauritius, and the Philippines to secure nitrogen (the only constituent of value in sulphate of ammonia), there is a much simpler way of obtaining it than by drawing on our supplies. Weight for weight, the nitrogen of nitrate of soda is more valuable for all crops than that in sulphate of ammonia. It is a product of Chile, whose supplies are this year reaching Europe for agricultural purposes in much reduced quantities. Let the countries and islands of the Indian Ocean and the Pacific, therefore, look to Chile for their supplies, and so avoid submarine perils and a heavier freight. The fact is that the seriousness of the action of the Government in allowing 250,000 tons of sulphate of ammonia to leave this country in 1916 is much increased by a consideration of the present position of nitrate of soda. In 1915, we imported over 130,000 tons of this material; whereas this year our imports are unlikely to reach 30,000 tons. Allowing for re-exports, Britain has suffered a loss of about 50,000 tons of nitrate of soda, which can only be compensated for by the retention of 37,500 tons of sulphate of ammonia, in addition to what we would otherwise have reserved from export. There is no evidence that any such foresight has been exercised. I did not contemplate the Sulphate of Ammonia Association financing farmers. That is a matter for the Goverment, as, indeed, the Chairman of the Association suggests. With reasonable organization, there is no fear of any inconvenient congestion of stocks.

GAS SUPPLY OF CHICAGO.

Visitors to Chicago in connection with the recent meeting of the American Gas Institute had an opportunity of inspecting the various departments under the control of the Peoples' Gas Light and Coke Company, which, since its consolidation of the various gas undertakings supplying the city and district, in 1897, has developed a class of service that is unsurpassed by any other city in America.

The district supplied by the Company extends a considerable distance along the shore of the Chicago River; the frontage being three or four times greater than the depth. The gas, with the exception of

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a small quantity purchased from outside sources, is at present exclusively carburetted water gas, manufactured at six large stations; but the Company are contemplating the erection of a new coal-gas plant, of sufficient capacity to take care of the whole requirement. The plans are all in order, and will be carried out as soon as negotiations with the City Council, now in progress, for the substitution of a calorific standard in place of the existing photometric standard have been completed.

For these and the following particulars, we are indebted to a fully illustrated description, with map, that appeared in "Gas Record," an interesting fortnightly publication that hails from Chicago. Three of the six manufacturing stations adjoin, or are close together, in the centre of the district, and the others are in outlying localities that appear to be important suburbs. In addition to the six gas-works, there are four outlying district distributing stations, forming ten on the whole. The plant includes 28 rotary positive exhausters, of a capacity ranging from 500,000 cubic feet to 1,000,000 cubic feet per hour, which take gas from holders having an aggregate capacity of 60 million cubic feet, and deliver it to a network of feeder line mains comprising 144 miles run of cast-iron socket and spigot pipes, varying from 6 to 36 inches in diameter. All the exhausting or pumping plant on the distributing system is arranged to deliver at 6 lbs. per square inch pressure. The exhausters fixed at or near the manufacturing stations are driven by steam-engines of the most modern type, and those at the outlying stations are actuated by gas engines of 300 to 600 H.P., according to capacity. From the feeder line system, the gas passes to the low pressure or consumers' mains, through 74 district reducing governors, which are installed in large concrete underground vaults below the streets, and which maintain on the outlet an even 60-10ths of an inch of water pressure. The low-pressure mains include 2858 miles run of cast-iron pipes, ranging from 4 to 36 inches in diameter, and supplying approximately 600,000 consumers. The feeder system is controlled by district valves in such a manner that any given section can be shut-off without interference with the general supply.

Details as to manufacturing capacity are given in respect to two stations—Division Street and Pitney Court. The producing power at Division Street is 20 million cubic feet of gas per twenty-four hours; and the generating plant includes six 12-feet Williamson water-gas sets, equipped with motor driven rolling grates and separate turbo-driven air-blast. There are also three 11 feet twin-sets. The works exhausters comprise two of the Connersville type, with a capacity of a million cubic feet per hour each, driven by 200 H.P. Lentz steam-engines; and the gas, after being delivered into holders representing 4 million cubic feet capacity, is distributed by four 24-inch high-pressure feeding lines radiating from the site by two Connersville exhausters and two Root blowers, driven by Lentz engines. The united capacity is over 3 million cubic feet per hour. The waste steam from the engines passes through a heater of special design, and is delivered to the generators in the carburetted water-gas house.

At Pitney Court there are four 11-feet and six 8 ft. 6 in. United Gas Improvement sets, having an aggregate capacity of 14 million cubic feet per twenty-four hours, fitted with specially-designed Pitot tubes, for measuring hot gases at the outlet of the superheater. A special feature at these works is a General Electric centrifugal compressor, connected direct to a 150 H.P. Curtis steam-turbine running at 3600 revolutions per minute, used for the purpose of transferring the gas made at the works to storage holders a mile away.

The four distributing stations using gas for power are: Irving Park, two 500,000 cubic feet Root exhausters, direct connected to 350 H.P. tandem four-cycle Buckeye gas engines; Thirty-First Street Station, two one million cubic feet Connersville exhausters, direct connected to 500 H.P. Allis-Chalmers four-cycle tandem gas-engines; Sixty-Fourth Street Station, two similar exhausters, direct connected to 500 H.P. tandem four-cycle Snow gas-engines, and a gasholder of 5 million cubic feet capacity; and the Twelfth Street Station is a reproduction of Sixty-Fourth Street. In addition to a very substantial central gas building, rising some twenty storeys, with a heavy base and cornice, which is considered to be the finest office block in Chicago, there are four district offices and show-rooms, a general laboratory, and an extensive and completely equipped industrial laboratory, containing over a hundred gas appliances connected up ready for use, including gas-fired steam-boilers; hardening, tempering, and annealing furnaces; japanning and enamelling ovens; metal-melting furnaces; soldering iron heaters; confectioner's furnaces, &c.; also precision instruments and all the necessary appliances for making working tests. If a prospect wishes to make any observations for himself, a motor-car will be sent to fetch him or his assistants, materials, parts, &c.

A special feature is the welfare work conducted among the employees, which includes rest rooms for women, with a matron in attendance; a large smoking and recreation room for men; well-fitted bath rooms and lavatories; a library of 2000 volumes covering every detail of the business; a restaurant where 600 or 700 employees are served with the mid-day meal at a very low tariff, prepared in a model kitchen that has been acknowledged by an inspector of restaurants to leave no margin for improvement; gratuitous first aid and medical treatment, a system of ambulance classes and prompt attention to all accidents, full salary during disability, &c.

The supply of gas was commenced in 1849, and six years later the People's Gas Light and Coke Company was incorporated, with full power to manufacture, distribute, and sell gas in the city. In 1897, a consolidation was effected, by which seven other gas undertakings were merged, and a year later three others joined the combination. In 1907, a lease was acquired of two more concerns; and since that date, the Company have had entire control of the gas business in the city and district of Chicago.

Lance-Corporal Minshall, of the Signalling Company of the Royal Engineers, who has been awarded the Military Medal, was formerly employed by the Leeds Corporation Gas-Mains Department.

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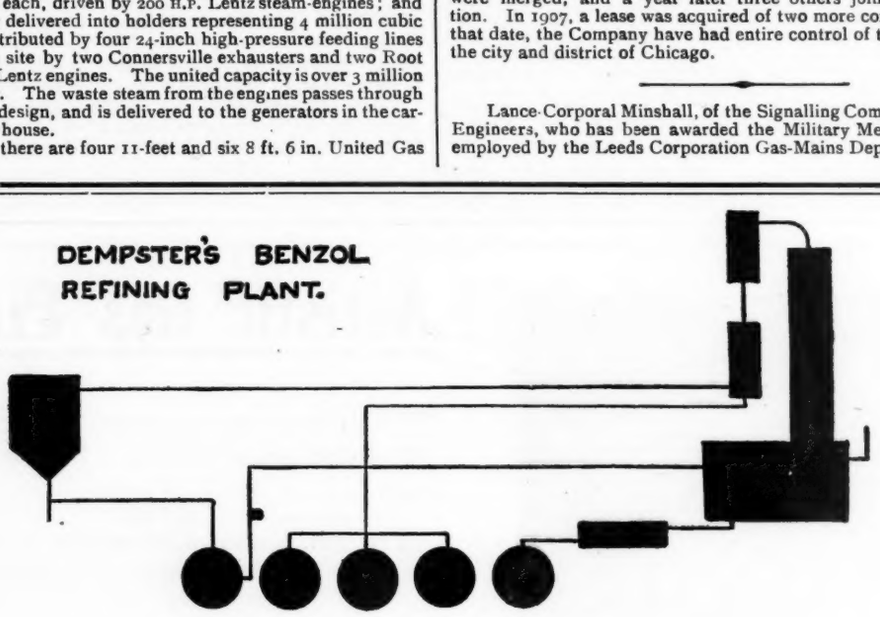

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NOTES FROM SCOTLAND.

Naphthalene Troubles in Glasgow.—Replying to a question at the meeting of the Glasgow Corporation, as to the cause of the poor pressure of gas experienced in many districts of the city, Bailie Drummond explained that there was no shortage of gas supply; but owing to them having to meet the demands of the Ministry of Munitions, there had been considerable trouble both to consumers and the department through the service-pipes becoming choked up sometimes with naphthalene. They had taken particular measures at the works to try to obviate this difficulty, and the number of complaints had now been considerably reduced. But in view of the shortage of labour and the excessive number of complaints received, he thought this was an adequate explanation.

Dundee and Coke Distribution.—The question of the distribution and sale of coke at the gas-works was raised by Bailie Noble at a meeting some days ago of the Dundee Gas Committee. He pointed out that the Food Prices Committee had suggested that the distribution of coke, which had been going on in a small way for a considerable number of years, might be developed to the benefit of the poorer class of the community by the opening of depôts at Lochee and in the West Port district. Bailie Noble expressed himself in agreement with the proposal, and explained that, to the price of 18s. per ton, which would be the charge for coke for sale at the gas-works, there would have to be added, in the case of Lochee, 4s. in respect of cartage, and 2s. 9d. in the case of any depôt opened at West Port. The ex-Convener suggested that they should adopt a general average price, so as to do away with the selling of small quantities for 2d. or 3d. at the gas-works. The Convener (Mr. High) said they could sell coke elsewhere at 23s. per ton; but they were willing to make a sacrifice in the interests of the poor people. A Committee was appointed to confer with the Food Prices Committee on the matter.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 4.

Pitch continues firm, and the export price is not below 21s. per ton net in bulk at makers' works. There is a fair amount of inquiry. Creosote is receiving a good deal of attention from various directions; and there are prospects of a greatly extended market for the use of this material. The price is firm at 4d. per gallon net and naked at works. Solvent naphtha is in good demand at 2s. 3d. per gallon net and naked, for 95-160 quality. Other products remain unchanged.

Sulphate of ammonia continues to improve, and makers' price for 25 per cent. quality, for prompt delivery for export, would not be below £18 per ton net filled into buyers' bags at works.

Tar Products in the Provinces.

Dec. 4.

There is nothing fresh to report concerning the market for tar products, and on the whole prices remain the same. No sales of importance in pitch are reported. Solvent naphtha is quiet; but the price remains fairly steady. Creosote maintains its price.

The average values of gas-works products during the past week were: Gas-works coal tar, 17s. 6d. to 21s. 6d. Pitch, East Coast, 16s. to 16s. 6d. per ton; West Coast—Manchester 15s. to 15s. 6d., Liverpool 16s. to 16s. 6d., Clyde 17s. to 18s. Benzol, 90 per cent., North, 10¾d. to 11¼d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6⅝d. Solvent naphtha, naked, North, 1s. 10d. to 1s. 11d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3d. to 3⅛d. Heavy oils, in bulk, North, 3⅛d. to 3¼d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 70s. to 80s., bags included. Anthracene, "A" quality, 2⅝d. to 3d. per unit; "B quality," ⅜d. to 1d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 2.

In the early part of the week the market remained quietly steady, but towards the close there has been renewed vigour in the demand, and a further rise in values has taken place. To-day's prices for December delivery are £18 2s. 6d. per ton f.o.b. Hull, £18 7s. 6d. f.o.b. Liverpool, and £18 10s. f.o.b. Leith. In the forward position it is reported that £18 15s. per ton f.o.b. good port has been paid for January-March delivery. Some manufacturers are now asking more money; but buyers do not seem inclined to follow them.

Nitrate of Soda.

This market has continued firm, and spot quotations are well maintained at 18s. 3d. per cwt. for ordinary quality and 18s. 9d. per cwt. for refined.

Sulphate of Ammonia.

From another source the quotations are given as follows: Outside London makes, £16 17s. 6d. to £17; Hull, £17 12s. 6d. to £17 15s.; Leith, £18; Liverpool, £17 17s. 6d.; Middlesbrough, £17 15s.

Fusing Electric Wire Causes a Theatre Fire.—A fire which is supposed to have owed its origin to the fusing of an electric wire, broke out in the Princess's Theatre, Crayford, last Friday night. The building had only been open for about four months. It was near midnight when the outbreak was discovered; and although all the local brigades worked hard, the theatre was destroyed.

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COAL TRADE REPORT.

Northern Coal Trade.

There is a stronger demand for coal, and supplies are fairly good; but owing to the scarcity of steamers shipments are in some measure restricted, and prices are a little irregular. The steam coal trade depending chiefly on the export demand, is the most affected. Prices are quoted from 28s. 6d. to 30s. per ton for best Northumbrians, about 27s. 6d. for second-class steams, and from 17s. 6d. to 19s. 6d. for steam smalls, all f.o.b. according to grade. In the gas coal trade, there is now a fuller home demand; and the shipments seem to be a little heavier. Best Durham gas coals are from about 26s. to 28s. per ton f.o.b., but with some variation according to the time of shipment. Second-class gas coals are near 19s. to 21s. per ton, and "Wear" specials may be quoted as from 27s. 6d. to 28s. 6d.; but much gas coal is being delivered on long contracts at prices ruled by "limitation" figures. The same remark applies to other kinds of Durham coal. There are now some negotiations for contracts for next year for gas coal for export. In the coke trade, on the whole the output is well taken up. Good gas coke is quoted from 33s. 6d. to 34s. 6d. per ton f.o.b. in the Tyne; the export needs being full. Freights are high; gas coal from the Tyne to London being about 15s., while coke to the northern ports of France is about 46s. per ton.

Wages at Brighouse.—The Brighouse Gas Committee have referred to the General Purposes Committee an application from the Gas-Workers' Union for an advance of the wages of stokers 6d. per shift; leading stokers, 5s. per week; and meter inspectors, 5s. per week. It is also asked that a full week's holiday with pay be granted to all gas-works labourers; and that, if called upon to work on Christmas Day and Good Friday, double time be paid.

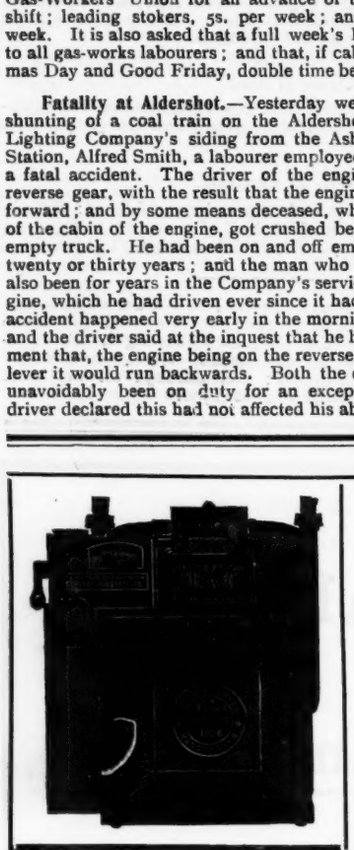
Fatality at Aldershot.—Yesterday week, while assisting with the shunting of a coal train on the Aldershot Gas, Water, and General Lighting Company's siding from the Ash Road works to Tongham Station, Alfred Smith, a labourer employed by the Company, met with a fatal accident. The driver of the engine applied the lever of the reverse gear, with the result that the engine went backward instead of forward; and by some means deceased, who was standing on the side of the cabin of the engine, got crushed between the coal-box and an empty truck. He had been on and off employed by the Company for twenty or thirty years; and the man who was driving the engine had also been for years in the Company's service. He was used to the engine, which he had driven ever since it had been on the works. The accident happened very early in the morning, when it was quite dark; and the driver said at the inquest that he had not realized at the moment that, the engine being on the reverse gear, when he touched the lever it would run backwards. Both the deceased and the driver had unavoidably been on duty for an exceptionally long spell; but the driver declared this had not affected his ability to drive the engine.

Some Uses of Coal Gas and Residual Products.

The Halifax Corporation Gas-Works were visited last Thursday by members of the local Textile Society, who were addressed by Mr. W. B. M'Lusky (the Engineer and Manager) on "Some Uses of Coal Gas and its Residual Products." Discussing the lighting of factories by gas, Mr. M'Lusky said it had been shown that the circulation of air created by gas-flames promoted ventilation. Each distribution pipe should be fitted with a special governor. This enabled the overlooker to increase or diminish the light at will, preventing waste by maintaining a constant and unvarying pressure. Shock-absorbers were required where the vibration was considerable. Inverted burners were the most economical. It was wise to aim at high pressure, high flame temperature, and low consumption. These conditions made all the difference between 20-candle power and 50-candle power per cubic foot of gas consumed. All burners should be tested once a year. Gas used in excess of the actual requirements of the burner shortened the life of the burner and the mantle. On the subject of residual products, Mr. M'Lusky remarked that one was tempted to say the gas industry of this country had been throwing away the cream and distributing the skimmed milk. Until the insane practice of allowing the surplus products of other countries to be dumped on us was discontinued, it was not possible to develop the bye-product business in this country on commercially sound lines. It would be necessary for the Government to put a duty on imports of this character. Our manufacturers would then be willing to pay a tax on their output; and from the funds accumulated from this tax, the Government would be able to develop the coal-tar and colour industries. When the war was over, steps would undoubtedly be taken to reduce the amount of coal burned in the raw state. Then gas would be a bye-product, and would be sold to the public generally at a very low price, which would certainly compete with that of raw coal, taking all the circumstances into account. Less than one-fifth of the 206 million tons of coal mined last year was treated for the recovery of bye-products.

Fire at a Gas-Works.—A fire occurred last Tuesday night at the Swan Village works of the Birmingham Corporation. The West Bromwich fire brigade were called; and upon arrival they found that a coal-shoot had in some way caught fire, and the flames had travelled to the top of the retort-house. The roof-timbers were burning when the firemen arrived; but the outbreak was extinguished before much damage had been done,

Chapel-en-le-Frith Gas Company.—Proposing the adoption of the report and accounts at the meeting of the Chapel-en-le-Frith, Whaley, and District Gas Company, Mr. T. Wright referred to the trying times of the past year, but said the Company had been prosperous. The shareholders had much to be thankful for, because, notwithstanding the difficulties that had had to be encountered, they were able to pay the same dividend as before—namely, 5 per cent.



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Newport (Mon.) Gas Company's Exemption Appeals.

Among a number of appeals heard recently by the Monmouthshire Appeals Tribunal were a batch of applications by the Newport Gas Company, for whom Mr. T. B. R. Wilson appeared. There were nine men applied for—a meter reader, a lamp repairer, two retort-setters, a gas-fitter, a storekeeper, two labourers, and a boilerman. Mr. Wilson emphasized the importance of maintaining the gas supply, not only for public and domestic uses, but in the interest of munition manufacture. As far as possible, the Company had done their best to provide men for the army. All the men inside the works were in a certified occupation; and these were the men applied for. They had sent 50 out of 129 men from inside the works, 32 from outside, and 7 from the staff. Only one man had been sent by order of the Tribunal. Mr. Thomas Canning and the Directors now felt that they had reached, and even passed, the margin of safety. A nucleus of experienced men must be retained. At present every man was overworked to a degree almost incredible. No other gas company in the country had released so many men; and Mr. Canning could not possibly spare more at present. Two of the men were Class A, and he was prepared to release one at the end of January, and the other at the end of February, if the other men were given conditional exemption. Captain Williams contended that the appeals were unnecessary. The fact was the Company wanted conditional exemptions, so that they need not make any effort to replace the men. The local Tribunal took a broad view, and granted as long a period as possible, with the right of re-hearing. Some of the men applied for worked a short time ago at a steam laundry; but they heard the band playing too loudly, so they rushed into the gas-works. Some of the other men were labourers. The Company wanted to be in a sense of security as compared with other employers. The offer of the Company regarding the Class A men was accepted; and in the other cases the decisions of the local Tribunal were upheld.

Gas Fatality at Poplar.—On a lodger returning home to a house in Poplar last week, he found that the landlord and landlady had not risen; and when entrance was gained to the bedroom, the man (who was 78 years old) was found dead in bed, and his wife unconscious. An incandescent gas-light was burning; and there was an unlighted gas-jet in the room, the tap of which had by some means been turned on. At the inquest, a verdict of "Accidental death" was returned.

Economy Urged at Coventry.—Consumers are appealed to by the Coventry Corporation Gas Committee to exercise the strictest economy in the use of gas during the ensuing winter months. Owing to the exceptional demands of factories engaged on Government work, the consumption of gas in the city has increased to such a large extent during the present year that the resources of the department are taxed to almost their full extent. In the past eight years, the output of gas in Coventry has more than doubled.

Government Control of Gas and Electricity in Australia.—It was announced a fortnight ago that, as a result of the coal strike then causing trouble, the Government were assuming control of the gas and electricity supplies in Sydney. The statement is now made that it is a punishable offence in Australia for any electric undertaking or gas company, without official consent, to supply motive power to an unspecified industry. Specified industries are those connected with the public services. Coal and coke may not be used for industrial purposes, except by special permit.

Price of Coal in Bradford.—To a question asked in Parliament by Mr. F. W. Jowett, the member for West Bradford, as to advances in retail coal prices in Bradford, Mr. Walter Runciman (the President of the Board of Trade) has replied by letter, enclosing a statement by the Bradford Town Clerk, based upon a report by Mr. Charles Wood (the Gas Engineer), which shows that the advance in Bradford generally is 5s. per ton on that of eighteen months ago. The price, Mr. Runciman points out, includes the 4s. increase in the pit price permitted by the Price of Coal (Limitation) Act; and he doubts whether any exception can be taken to it by the Government.

Gas Supply Difficulties at Bradford.—There has, according to the "Yorkshire Observer," been a decrease in the amount of gas produced at Bradford, owing to the shortage of stokers, with the result that any unusual drain upon the holders—such as a particularly dark winter's day—reduces the pressure considerably. An instance of this, it is said, occurred in Bradford on Friday when for some hours the public suffered a certain amount of inconvenience through the partial failure of the light. Not for many years has there been so marked a falling off in the supply; and it was coincident with an increased demand owing to fog. The daily production of gas in the city nowadays is about 7 million cubic feet.

Gas-Workers' Wages at Manchester.—An application having been made on behalf of the men employed at the Manchester Corporation Gas-Works for an increase of wages, the Gas Committee did not see their way clear to grant the request, and the matter was referred to the Committee on Production. Representatives of the parties were heard last month; but a decision was deferred pending negotiations in regard to a re-arrangement of shifts. The Committee's finding is "that, as from the beginning of the first full pay in November, 1916, the wages of the men concerned shall be advanced 2s. 6d. per week, the advance to be regarded as war wages, and recognized as due to, and dependent on, the existence of the abnormal conditions now prevailing in consequence of the war."

Messrs. Stewarts and Lloyds, Limited, of No. 41, Oswald Street, Glasgow, have issued a new illustrated booklet on the subject of Ashford's patent tube-well strainers for irrigation, town and village water supply, and other purposes. The strainer is the result of a long series of experiments conducted with a view to finding a satisfactory and economical arrangement for drawing large quantities of water from sandy soil without bringing away sand, and thereby causing subsidence of the soil. The need for such a device has been greatly felt in India, where the patentee, Mr. John Ashford, is engaged.

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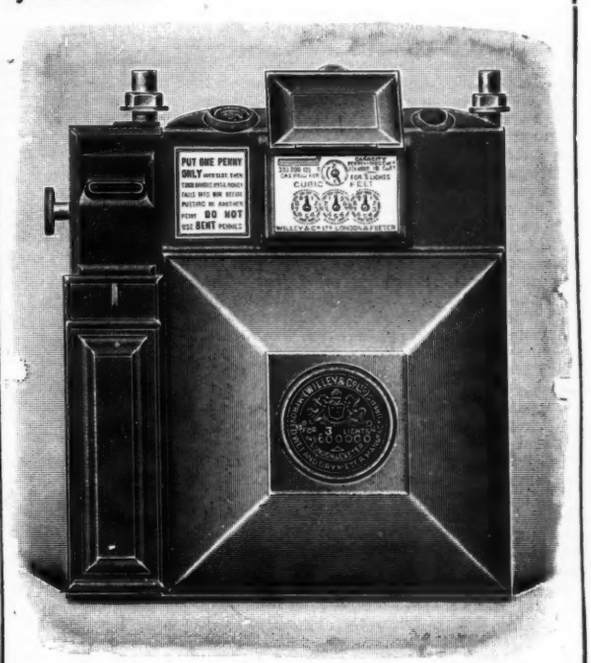
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STOCK MARKET REPORT.

THE Stock Exchange has had a rather better week as compared with the recent type of hebdomadel period. Not that markets in general were brighter, for in point of fact they were rather patchy; but there were good lines both in the choicer articles and in the more speculative quarters. How the improvement came about is not quite apparent on the face of it. Certainly it was not the War news, as the retirement of the Roumanians was not counterbalanced by an advance on our Western front.

Still, as the week progressed, the tendency towards more cheerful news materialized. It may perhaps be not too much to say that the signs of a growing public dissatisfaction threatening revolt against our rulers' endless drift and delay have cheered with a prospect of action at last; and, indeed, it is high time. In result, after a weak start, the gilt-edged market hardened, and War Loan and Consols closed firm. Home Rails were not uniformly down; but with labour questions in the melting pot, they could not do much. Americans and Canadians were irregular; but the last prices were not the worst of the week.

The Foreign Market was quiet and irregular. The French loans moved unevenly, but not much either way. Japanese were well supported; several South Americans zigzagged. Among the Miscellaneous were some good turns interspersed by realizations of profits which swung prices about.

Business in the Gas Market had a good deal more life in it, and a score of issues were dealt in for the first time for months. Prices in general showed no disposition to advance, and in some instances they were a little easier. The most interesting incident of the week was the Government assumption of control of the South Wales coalfields—a policy which is bound not to stop there. In the Money Market, there was a good demand; but the supply was equal to meeting all requirements.

Bargains done for cash during the week were as follows: On Monday, Brentford debenture 70, British 34¼, Continental Union 36½, Gas Light ordinary 71⅛, 71⅝, 72, 72⅛, 72½, ditto preference, 69½, 69¾, Imperial Continental 80, Newcastle, 79¼. Primitiva preference 65s., Tottenham "B" 90. On Tuesday, Bombay 5, Cape Town preference 4⅞, Gas Light ordinary 71½, ditto debenture 59, Imperial Continental 75, 78, Primitiva 40s., ditto preference 63s 9d., South Metropolitan 83, 83⅝, 84. On Wednesday, Brentford "B" 83½, British 34⅛, 34½, European 12, Gas Light ordinary 71, 71¼, 72, ditto preference 69¾, ditto debenture 58¾, Imperial Continental 75½, South Metropolitan 82⅝, 83, 83½, 83¾, Tottenham "B" 90½, ditto debenture 67, 67½. On Thursday, Brentford "A" 85, 86, 86½, ditto "B" 83, Croydon "C" 170, 171, Gas Light ordinary 71⅛, 72, 72½, ditto preference 69¼, 69½, ditto debenture 58, 58½, 59, Primitiva preference 62s. 6d., South Suburban West Kent 73, Tottenham "B" 90⅛, 90½, ditto debenture 67. On Friday, British 34½, European 12, Gas Light ordinary 71, 71⅛, 71½, 71¾, 72, ditto debenture 58, Primitiva 40s., 7½d., ditto preference 65s., South Metropolitan 83½, South Suburban West Kent 70, Totenham debenture 67½. On Saturday, British 34⅛, Gas Light ordinary 71, ditto maximum 56, 56½, 57, Imperial Continental 74, Primitiva 63s. 9d., South Metropolitan 83.

The Bank rate is 6 per cent.—as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	65—70	..
1,651,868	"	April 8	9½	5¼%	Alliance & Dublin Ord.	59—64	62—64	..
874,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76—79	60—65	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅞—6¼	4⅞—5⅛	5
80,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water { B ¶ p.c.	26—30	26—27	..
393,110	10	"	¶	7/-	Pref. 6 p.c.	15—15½	11—11½	..
115,000	10	"	6	6/-	4 p.c. Deb.	13½—14	9¼—10	..
153,740	—	—	—	4%		..	73—75	..
993,045	Stk.	Feb. 26	†14	55/-	Brentford A Consold.	281—286	85—87	85—86½
734,920	"	"	†11	53/9	Do. B New	204—209	83—85	83—83½
51,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	85—90	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—98	69—71	70
217,880	Stk.	Feb. 26	11	10½%	Brighton & Hove Orig.	208—218	160—165	..
244,300	"	"	8	7¾%	Do. A Ord. Stk.	154—159	121—124	..
630,000	20	Mar. 26	19½	22/6	British	44—45	34—35	34½—34½
190,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	68—70	..
945,771	Stk.	June 26	4	4%	Buenos Ayres 4 p.c. Deb.	85—87	60—65	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	1½—1⅝	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	4⅛—5*	4⅝
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	Stk.	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	82—83	..
1,615,380	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	72—74	..
660,000	"	"	5½	46/8	Do. 3½ p.c. do.	103—105	68—70	..
475,000	"	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	55—57	..
800 000	Stk.	"	4	—	Continental Union, Ltd.	76—79	36—38	36½
300 000	"	"	7	—	Do. 7 p.c. Pref.	115—118	57—59	..
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	175—185	170—171
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5¾%	Derby Con. Stk.	128—125	100—105	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,009,180	10	July 29	10	7/6	European, Ltd.	17½—18	12—13	12
16,313,430	Stk.	Feb. 10	1/17/4	42/-	Gas Light and Coke { 4 p.c. Ord.	98—102	71—72	71—72½
2,600,000	"	"	8½	3¾%	5½ p.c. max.	76—79	55—58	56—57
4,062,235	"	"	4	4%	4 p.c. Con. Pref.	96—99	6½—71	69½—69⅝
4,674,850	"	June 11	8	8%	8 p.c. Con. Deb.	72½—74½	58—60	58—59
180,000	"	"	10	10%	10 p.c. Bonds	..	..	..
258,740	Stk.	Mar. 12	5	4½%	Hastings & St. L. 5½ p.c.	87—89	78—83	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16½	8—9	..
86,600	—	—	—	9½%	Hornsey 7 p.c.	..	125—135	..
131,000	Stk.	Mar. 12	7½	7½%	Ilford A and C	151—154	112—117	..
65,780	"	"	6½	5¾%	Do. B	115—119	103—108	..
65,500	"	June 26	4	4%	Do. 4 p.c. Deb.	92—94	73—76	..
4,940,000	Stk.	May 14	9	4½%	Imperial Continental	150—160	74 79	74—78
1,235,000	Stk.	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,242	Stk.	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	87—92	..
2,498,905	Stk.	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A	211—218	86—87	..
					B	146—148		
306,083	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	75—77	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4¾	4—4½	..
250,000	100	April 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	89—93	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8½—9*	..
1,875,892	Stk.	July 29	4½	4½%	Newc'tle&G'tesh'd Con.	98½—99½	79—80	79½
592,705	Stk.	June 26	3¾	3¾%	Do. 3½ p.c. Deb.	85—88	75—77	..
55,940	10	Feb. 26	7/14/0	7/8/-	North Middlesex 7 p.c.	14—16	10½—11½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	104—106*	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	2—3	..
60,000	50	Feb. 26	13	12½%	Portsea, Island B	128—131	95—100	..
100,000	50	"	12	11%	Do. C	118—121	88—93	..
52,000	50	"	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	2 2½	40/—40/7½
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4⅞—5	3 3½	64/6—65/-
521,600	100	June 2	4	4%	" 4 p.c. Deb.	91—98	78—80*	..
—	—	—	—	4%	" " " 1911	..	..	..
846,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	63—68	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	8—8½	..
125,000	50	July 1	5	5%	5 p.c. Deb.	47—49	43—45	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—234	188—192	..
209,984	"	"	10	10%	Do. B	222—234	188—192	..
523,500	"	"	10	10%	Do. C	220—222	188—192	..
90,000	10	May 28	9	6.-	South African	10½—11½	..	..
5,609,895	Stk.	Feb. 10	5/4,0	44/-	South Met., 4 p.c. Ord.	111—113	82—84	82½—84
1,895,445	"	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	59—61	..
224,830	Stk.	Feb. 26	8½	8%	South Shields Con. Stk.	157—159	145—147	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	80—82	..
60,000	"	"	5	5%	Do. 5 p.c. Pref.	110—113	79—81	..
135,000	—	—	—	48/4	Do. West Kent,	..	..	70—73
187,558	"	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	90—92	..
647,740	Stk.	May 14	5	5%	Southampton Ord.	99—102	88—93	..
190,000	Stk.	Feb. 12	7½	7½%	Tottenham { A 5 p.c.	135—138	120—123	..
782,275	"	"	6	5⅝%	District { B 3½ p.c.	115—117	90—92	90—90½
181,255	"	June 26	4	4%	4 p.c. Deb.	87—89	67—69	67—67½
189,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
286,476	Stk.	Mar. 12	5	5%	Tynemouth, 5 p.c. max.	108½—109½	91—92	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8½	78/9	Wandsworth A 5 p.c.	151—156	117—122	..
255,686	"	"	6½	63/9	" B 3½ p.c.	129—134	101—103	..
108,075	"	"	5/17/8	55/1½	" C 3½ p.c.	110—115	88—93	..
352,000	"	"	6½	57/6	Wimbledon 5 p.c.	117—122	9)—95	..
98,000	"	"	6½	63/9	Epsom 5 p.c.	121—126	98—103	..
88,416	..	June 26	3	3%	3 p.c. Deb. Stk.	66—69	53—56	..

* Ex. div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

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